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Title: Elite female athletes' experiences and perceptions of the menstrual cycle on training and sport performance

Running head: Perceptions of the menstrual cycle in sport

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Abstract

1
2 The purpose of the current study was two-fold; 1) to examine elite female athletes' experiences
3 of their menstrual cycle, with a focus upon the impact on training and competition performance, and 2)
4 the openness of conversation pertaining to the menstrual cycle with coaching and support staff. Following
5 receipt of institutional ethical approval, individual semi-structured interviews were conducted with 17
6 elite female athletes (25.5 ± 4.7 yrs) from multiple sports. Results revealed athletes' experiencing a natural
7 menstrual cycle reported physical symptoms alongside mood disturbances and reduced motivation to
8 train. The decision to actively control the menstrual cycle was often triggered by a desire to reduce the
9 effect on competition, to lessen anxieties about making required weight or reduce distraction to manage
10 during competition. Athletes indicated an openness to talk about the menstrual cycle to other females,
11 however, there was variation in the comfort athletes experienced regarding talking to male coaches.

12 Overall, the findings highlight the need to educate elite athletes and coaches on the menstrual
13 cycle, considering it in the same light as other physiological functions in sport to improve health,
14 wellbeing and performance. Furthermore, providing education on how to construct positive
15 conversations, equipping individuals with the correct terminology, and confidence to talk about the
16 menstrual cycle will reduce some reservations identified through improved knowledge and
17 understanding.

18 **Key Words: menstrual cycle, female, athletes, symptoms, performance**

Introduction

19
20
21 The female reproductive life cycle is one of the most important biological rhythms¹ with the
22 menstrual cycle being a perfect example of a bio-psycho-social process; it is a normal aspect of physiology
23 that both affects and is affected by behaviour². However, research has shown that many females feel
24 advice and information they receive is focussed on the biology of menstruation and suggest this should be
25 shifted to personal, subjective and lived experiences³. The literature to date has concentrated on the
26 biological process involved in the menstrual cycle, with emerging research on the impact of sport
27 performance, yet personal and lived experiences have infrequently been investigated. This may result
28 from menstruation remaining a hidden topic, rarely spoken about and also considered a topic of shame
29 and embarrassment⁴. Reports have highlighted menstrual stigma still existing and considered an
30 educational and socio-economic issue across the world; a survey identified 1 in 4 girls did not feel they
31 knew what to do when they started their period, with 48% of girls feeling embarrassed by their period⁴.
32 Despite a number of international campaigns focusing on breaking down the stigma, this still exists within
33 sport and wider society.

34 For the body to function properly, its various parts and organs must communicate with each
35 other to ensure that a constant internal environment (i.e., homeostasis) is maintained. Communication
36 among various regions of the body is essential for enabling the organism to respond appropriately to any
37 changes in the internal and external environments⁵. Hormonal communication relies on the production
38 and release of hormones from various glands and on the transport of those hormones via the
39 bloodstream. Specifically hypothalamic hormones play pivotal roles in the regulation of many functions
40 including eating and drinking, sexual functions, behaviours, blood pressure and heart rate, body
41 temperature maintenance, the sleep-wake cycle, and emotional states (e.g., fear, pain, anger, and
42 pleasure)⁵.

43 The menstrual cycle is the result of the actions of the hypothalamic, hypophyseal and ovarian
44 hormones bringing about various changes in the female reproductive system as well as many other
45 tissues of the body¹. The menstrual cycle encompasses two main phases associated with fluctuating
46 levels of hormones, the follicular phase and the luteal phase. Besides from reproductive function, female
47 sex hormones are known to affect numerous other cardiovascular, respiratory, thermoregulatory and
48 metabolic parameters⁶. Therefore, at each stage of the menstrual cycle, throughout a cycling month, it
49 can theoretically affect sporting performance in different ways. However, the effects of the menstrual
50 cycle (and the associated hormonal fluctuations) on sporting performance have largely been
51 unaccounted⁷. And whilst more studies are starting to emerge, there are still many questions with
52 indefinite answers. Further disparity exists when considering contraceptives. With the primary aim to
53 prevent pregnancy, the change in physiology resulting from exogenous hormones may affect sporting
54 performance⁸. The literature is confounded by the complexity in the various contraceptive types,
55 containing differing levels of hormones; some are oestrogen and progestin (combined pill), whereas
56 others contain progestin only (mini pill, implant, mirena coil, injection). The different forms of
57 contraceptives can result in the prevention or increase in symptoms experienced by female athletes⁸.

58 Understanding the impact of the menstrual cycle on exercise for females is critical for sport
59 professionals and coaches to appropriately prescribe training, alongside ensuring optimal health and
60 wellbeing⁹. Specifically, oestrogen can influence the cardiovascular system, substrate metabolism and the
61 brain¹. Whereas, progesterone and other progestins appear to mainly affect thermoregulation,
62 ventilation and usage of fuel for energy needs¹. All of these factors associated with the menstrual cycle
63 can impact on athletic performance. Additionally O'Brien, Rapkin, Dennerstein & Nevatte¹⁰ evidenced
64 psychological and behavioural symptoms associated with the menstrual cycle can include fatigue,
65 lethargy, poor coordination and concentration; all factors which may impact upon sport performance.

66 Research informing practitioners of best-practice methods for maximising exercise performance
67 and training adaptation in females is limited⁹. Emmonds et al.¹¹ highlight evidence-informed approaches
68 remain a challenge for those working in female sport, with a lack of sport science and medicine research
69 conducted on elite female athletes. Research highlights 51.1% of elite British female runners and rowers
70 felt their menstrual cycle had in some way impacted upon their training and performance⁷ in contrast,
71 Olympic medal-winning performances have taken place during all phases of the cycle¹². There is much
72 variation in individual symptoms, subsequently, there is a need to understand individual lived experiences
73 and perceptions. It is valuable to understand how the menstrual cycle is perceived to impact on training
74 and competition, rather than group averages, to influence best practice and optimise support provided by
75 coaches and practitioners to resolve issues relating to health, wellbeing and sporting performance¹³.

76 Despite the menstrual cycle potentially influencing a number of physiological and psychological
77 constructs as previously highlighted, we are yet to establish an open environment in which the menstrual
78 cycle is discussed equally with any other physiological determinants within sport performance⁷. This lack
79 of consideration may be attributed to a variety of factors, either the limited research within this area or
80 resulting from athletes' individual experiences of their menstrual cycle and their discomfort having
81 conversations on this topic with members of their support network as highlighted by Findlay et al.¹⁴
82 noting female rugby players felt unease at having menstrual cycle conversations with male support staff.
83 Women still try to conceal they are menstruating or experiencing premenstrual symptoms, this negative
84 attitude towards menstruation has been reinforced by products and media. It is important to recognise
85 that through advertising and the power of social media, the messages put forward by large corporations
86 can impact on perceptions. Many adverts for menstrual products have a consistent theme, namely
87 emphasising the importance of secrecy, implying dirtiness and the need to avoid social embarrassment⁴.
88 This is a powerful message to readers and viewers that they should keep the evidence of menses out of
89 sight¹⁵. Johnston-Robledo & Chrisler¹⁵ identified booklets used to educate girls before menarche might
90 learn more about stigma than about their physiology. One booklet stated "your main concern will
91 probably be avoiding accidents...and using a pad that doesn't show." The emphasis on secrecy and the
92 potential for embarrassment is present in many of the booklets, and this emphasis may contribute to
93 negative attitudes toward menstruation¹⁶.

94 The communication taboo is supported by the existence of dozens of euphemisms for
95 menstruation. If there was an open environment to talk about menstrual blood there would be no reason
96 to call it anything other than menstruation or menses¹⁷. Within elite team sport, one study identified that
97 some athletes have expressed a reluctance to confide in their coaches relating to the menstrual cycle due
98 to reported awkwardness, embarrassment, gender differences and feeling like there would be nothing

99 that the coach could do to help them¹⁴. Communication is a fundamental part of coaching, yet when
100 focussing on the menstrual cycle, previous research has highlighted male coaches, compared to female
101 coaches, reported it was less important to ask athletes about menstrual irregularity, being less
102 comfortable communicating with female athletes about the topic¹⁸. Female athletes in high performance
103 sport are more likely to have a male coach, therefore research has questioned whether coaches are
104 sufficiently prepared to respond on a more individual basis to their athletes along the lines of gender¹⁹.
105 Male coaches may adjust their coaching practices to the detriment of their female athletes²⁰.
106 Furthermore, previous research has highlighted, coaches of elite athletes are expected to coordinate the
107 communication between the different members of the support team and to plan and prepare for long-
108 term development and participation in elite competition. This requires communicating with people to
109 optimize performance within a mindful environment²¹; the absence of communication between coach
110 and athletes pertaining to the menstrual cycle may have a consequential impact on sport performance.
111 The impact of (unequal) gender relations and the significance of gendered ideas and expectations may
112 currently influence the effectiveness of coach–athlete relationships²⁰. Fundamentally, Johnston-Robledo &
113 Chrisler¹⁵ commented, if menstruation were discussed more openly, it might be easier for girls and
114 women to acknowledge the positive aspects of menstruation.

115 There is a great need for continuing research in this area in carefully designed studies, including
116 understanding athletes' experiences in relation to their perceived impact of the menstrual cycle on
117 performance and their ability to discuss this with others. Research needs to further increase knowledge
118 and understanding of individual lived experiences across multiple sports, whilst promoting conversations
119 relating to the menstrual cycle. This study aimed to produce a paper that provided a substantive
120 contribution to the understanding of elite females athletes by examining:

- 121 1) Elite female athletes' experiences of their menstrual cycle, with a specific focus upon the
122 perceived impact it has on training and competition performance.
- 123 2) The openness of conversation pertaining to the menstrual cycle with coaching and support staff.

124 **Method**

125 To address the aims of this study and facilitate an in-depth understanding of elite female athletes'
126 experiences, a qualitative descriptive study^{22,23}. Interpretive descriptive studies seek to gain in-depth
127 insights from participants pertaining to their experiences, while producing descriptive accounts that
128 remain close to the participants words and produce insights that may be useful in practice. Given the aim
129 of this study was to produce data that could stimulate and encourage conversations among athletes, this
130 approach was deemed particularly valuable. Such studies generally use a combination of purposive
131 sampling, data collection through unstructured or semi-structured interviews, and a variant of qualitative

132 content analysis^{22,23}. As such, these approaches to data collection and analysis methods were used within
133 the current study.

134 Qualitative description is not underpinned by any specific philosophic foundations other than
135 being guided by the general tenets of naturalistic inquiry²². The current study, however, was positioned
136 within the interpretivist paradigm, underpinned by ontological relativism and epistemological
137 constructionism. That is, within this study, it was assumed that reality is multiple and subjective and that
138 knowledge is socially constructed²⁴. Thus, it is recognized that each participant will have their own unique
139 experience of the phenomena and that there is no one truth or experience. Rather, the results of this
140 study illustrate the co-constructed experiences of the participants and the research team, highlighting
141 both shared/common patterns in experiences as well as individual differences.

142 **Participants**

143 Seventeen elite female athletes (age 25.5 ± 4.7) from a range of sports (Table 1) were
144 purposefully sampled based on (a) sex (biologically menstruating females), (b) identifying as female, (c)
145 their level of competition experience and (d) the length of time participating and competing in their sport.
146 It is important to note sex versus gender differences; sex describes biological differences including
147 genetic, hormonal and physiological factors in comparison to describing gender, in which social constructs
148 interact²⁵. It has been acknowledged that not all people who were assigned female at birth, or who
149 identify as female, menstruate. Conversely, there are people who identify as genders other than female
150 (such as transgender, intersex and non-binary people) who also menstruate⁴. For this reason, and the
151 focus of the current study, both biologically menstruating and identifying as female were inclusion criteria
152 for this study.

153 All sports except climbing required competing at British level or above for a minimum of 3 years,
154 with all having competed at Goldcoast Commonwealth Games 2018. Female climbers were selected
155 based predominately on outside climbing grade achieved; minimum of climbing grade 8a was required,
156 with six participants having climbed 8b or above and all having bouldered V10 or above. All athletes
157 interviewed were in a pre-competitive phase of training. In alignment with Patton²⁶ these criteria were
158 applied to ensure information rich participants were sampled to learn about matters of central
159 importance to the purpose of this study, focusing specifically on elite female athletes experiences of their
160 menstrual cycle and openness of conversation. This allowed for greater insights and in-depth
161 understanding to be obtained in relation to the questions under study.

162 *****Insert Table 1 around here*****

163 **Procedure**

164 Following receipt of institutional ethical approval, the lead researcher contacted coaches and
165 sport science practitioners working with each sport to facilitate organization of the research project,
166 forwarding details of the study. Interested female athletes provided contact details to the research team,
167 and suitable times for an interview was arranged. Prior to the interview, both written and verbal
168 explanation of the study was provided and participants were given the opportunity to ask questions. It
169 was re-emphasized that participation was voluntary and there were no right or wrong answers to the
170 questions. Once informed written consent was provided by all participants, the participants were asked to
171 provide, through a short written survey, some key pieces of demographic information such as their age,
172 years in the sport as well as information regarding their menstrual cycle and contraceptive products being
173 used. This short written survey was used to ensure all necessary demographic information was collected
174 without distracting from the flow of the interview. Additionally, having this information at the outset of
175 the interview ensured the interviewer could ask appropriate questions relating to the form of
176 contraceptives being used by the participant. Before interviewing the female athletes, the interview guide
177 was piloted with three recreationally active females to assess whether questions elicited sufficient depth,
178 while allowing the interviewer to practice use of clarification of questions. Following the pilot interviews,
179 several changes were made to the interview guide specific to participants taking contraceptives and
180 provided a more comprehensive history and experience of taking this in relation to training and sport
181 performance.

182 The final interview guide started with introductory questions, followed by main questions and
183 finished with requested information from female athletes. Introductory questions sought to identify
184 demographic information such as age, duration and level of involvement within their sport. Participants
185 were then asked main questions about their lived experiences of the menstrual cycle, if and how this had
186 changed with age and perception of the menstrual cycle in relation to their training requirements and
187 competitions. This progressed onto openness of conversations about their menstrual cycle with coaches
188 and individuals within their support network. Following this, participants were given the opportunity to
189 request any information or support they had questions about or felt lacked knowledge on in relation to
190 their menstrual cycle (See Appendix A). Following introductions and discussions regarding the purpose of
191 the study, all interviews lasted between 34.1 and 62.5 min ($M = 47.1$ min). The first author was
192 responsible for conducting all interviews due to familiarity established whilst working within their sports
193 and training environment. Through such engagement, the first author gained a greater understanding of
194 the individuals sporting context and environment which facilitated the development of rapport with the
195 participants and aided understanding of the experiences they were describing. It was hoped that the
196 participants would feel more comfortable and openly discuss their thoughts and experiences relating to

197 the menstrual cycle. The first author's background is also worth noting, working in sport science, as well
198 as personal experience of sports such as climbing, helped relate and further understand experiences
199 described.

200 **Data Analysis**

201 Each interview was audio recorded and transcribed by a professional transcribing service.
202 Transcripts were checked for accuracy and any personal identifying information was removed, these were
203 then re-read by the first author to ensure immersion in the data. The transcripts from each participant
204 were analyzed by the first author using qualitative data analysis procedures recommended by Miles,
205 Huberman & Saldana²⁷. Data reduction was completed using three stages of coding. Firstly, descriptive
206 codes were assigned to the data to identify raw data themes, this allowed for interpretive codes to be
207 generated. These codes grouped descriptive codes into more abstract concepts. Lastly, pattern codes
208 were identified which recognized relationships between interpretive codes.

209 **Methodological rigour**

210 Techniques were conducted during and following analysis to enhance the rigor of data analysis.
211 First, the results were produced by researchers working as a team, the second author questioned the
212 analysis and asked for explanations and justifications for the codes produced. The next analytic step
213 involved the second author, questioning raw data themes, this resulted in some reorganization of the
214 grouping of the themes but not of the coding itself. This was repeated by the third author. The final phase
215 of analysis was the writing of the results section because writing is viewed as part of the analysis in
216 qualitative research²⁸. The final results, which are presented below, were evaluated, discussed, and
217 agreed upon by all three members of the research team. Although the basic themes remained the same,
218 the written presentation of these themes went through several iterations before the final representation
219 of the results was agreed upon. Credibility and transparency were sought through pilot interviews,
220 engagement with individuals within each sport and detailed interviews to gain broader insights beyond
221 the interview data. Maintaining the same interviewer ensured the nature of the interview, and in
222 particular the delivery of questions was kept relatively constant across all female athletes.

223 **Results**

224 Elite female athletes discussed a range of factors related to the menstrual cycle, although, in
225 some instances there was limited awareness of the impact the menstrual cycle may have on sport
226 performance. Despite the somewhat limited awareness, all female athletes reported symptoms
227 associated with the menstrual cycle which affected training more so than competition. Conversations
228 with coaches and support staff varied between athletes, with experiences of previous awkward
229 conversations influencing comfort and openness to future conversations. Overall, a word document of

230 approximately 111,613 words of transcribed text was analysed. Through analysis, 13 sub-themes and four
231 main themes were developed; (a) symptoms experienced, (b) menstrual cycle impact on training and
232 competition, (c) coping (or not) strategies of the menstrual cycle and (d) openness of conversations (Table
233 2); each of these are discussed below. Descriptive menstrual cycle data and hormonal contraceptive use
234 are displayed in table 3; five athletes reported to be currently using a form of hormonal contraceptive
235 (29%). Across all females, 71% of female athletes reported experiencing abdominal cramps, other
236 symptoms of bloating (65% reported) and agitated/irritability (59%) were the next most commonly
237 reported symptoms associated with the menstrual cycle. Furthermore, female athletes discussed
238 information they deemed valuable to receive about the menstrual cycle to improve knowledge and
239 awareness which was grouped into 5 key areas; 1) contraceptives including side effects, long term health
240 impact and effect on training; 2) menstrual products, what options are there and any products which are
241 preferential for different sports; 3) how the menstrual cycle can affect training and competition and
242 management strategies for these; 4) coach education, improving awareness and understanding and 5)
243 information for younger athletes and opportunities/advice of who to talk to.

244 *****Insert Table 2 & Table 3 around here*****

245 **Symptoms**

246 All athletes reported symptoms relating to their menstrual cycle; physical, affective or
247 psychological. These symptoms were associated with both a natural cycle or taking contraceptives,
248 irrespective of tracking their menstrual cycle and were reported to occur at different times within a cycle,
249 having a greater or lesser effect. In general, the week before menses to the end of menses was the
250 timeline in which symptoms were experienced. Symptoms were also reported to change with age as one
251 weightlifter explained, “my periods were definitely worse when I was a teenager” (W2), and also the
252 awareness of symptoms increasing with age. For instance, some participants had not initially associated
253 their symptoms to their menstrual cycle but through experience, tracking, and recording, their awareness
254 and understanding had increased “I have become more aware dealing with it [psychological symptoms]
255 but before I was just ‘I must just be grumpy’ I never really related to it, just lack of knowledge. Until I was
256 18 or 19 it was just the last thing on my mind so I’d never even considered it” (C2). Another female
257 athlete described “it never crossed my mind, before I didn’t even know it could affect your
258 performance...I wouldn’t even correlate it and join the dots and have the awareness to adjust training”
259 (W5).

260 All females reported experiencing at least two of the physical symptoms listed in Table 4 with the
261 most common being cramps/pain (71%). In contrast, not all athletes reported affective and psychological
262 symptoms; those reported included increased worry, unusually stressed, easily frustrated, reduced

263 motivation to train, disengaged, moody, agitated/irrational, reduced confidence, depressed, and
264 increased emotion (crying). Awareness of these symptoms appeared to be more variable and were
265 frequently recognized in older athletes who had a menstrual cycle for a longer time. Variability of
266 symptoms from one cycle to the next was expressed by some participants; “one month one thing will
267 happen, the next month something else will happen...it makes it difficult to be aware and have
268 conversations as its difficult to explain” (A1).

269 *****Insert Table 4 around here *****

270 Physical symptoms were generally reported to occur immediately prior to or at the start of
271 menses, whereas affective and psychological symptoms were generally greater the week prior to the
272 onset of menses. The varying extent of symptoms affected female athletes and how they felt, with
273 athletes generally perceiving their menses as “nightmare, it’s horrible” (C2), “feel like an actual blob” (C3),
274 “I feel blah, I feel heavier” (C4), “feel a bit lousy, once it comes its absolutely fine” (C6), and “first day is
275 always pretty grim, I just feel terrible” (C8).

276 Some athletes reported the use of contraceptives to manage associated physical symptoms such
277 as cramps and dermatology issues. Although some participants reported the convenience of not having
278 menses or withdraw bleeds due to contraceptives, others described negative experiences or symptoms,
279 with some participants not being aware that symptoms were a consequence of the contraceptives, as one
280 participant summarized:

281 When you start looking more into symptoms, it’s hard because I think a lot of women, myself
282 included, have been on contraception for so long and from a young age...and it’s so normalized
283 that it’s very hard to notice [symptoms]. But having come off it I feel I was very flatlined just like I
284 was quite a bit below par and unresponsive [in emotions and to train] (C3)

285 Other females reported different side effects; for instance, a weightlifter identified she was more
286 emotional, had continual bleeding, dermatological issues, and food craving resulting in no longer taking a
287 contraceptive pill “because [I was] emotional it was completely ruining my training” (W4). Meanwhile
288 other athletes reported associated symptoms of headaches, incredibly painful periods, and concern about
289 the long-term effects of very low hormone levels “I think my cramps are a bit worse but I don’t get the
290 headaches any more, that is why I came off the pill because of the headaches, well side effects really”
291 (C1).

292 **Impact on training and competition**

293 The symptoms associated with the menstrual cycle impacted on athletes during both training and
294 competition. Athletes’ perception of the impact of the menstrual cycle on performance varied and, in
295 some instances, athletes lacked awareness of how it may impact “I didn’t even know it could affect your

296 performance, it never crossed my mind when I was younger” (W5). For instance, many of the athletes
297 initially reported no impact of their symptoms on training, yet the majority followed up with statements
298 such as their menses/pre-menstrual syndrome symptoms left them feeling “out of action”, “feel rubbish”
299 and “sluggish during training”. As the interviews evolved, an impact on training became more notable,
300 with a large proportion of participants reporting feeling slower and lethargic during training, often lacking
301 motivation to go in the first place as one weightlifter summarized, “I’d rather eat chocolate and watch TV
302 on the sofa” (W2).

303 Physical symptoms of pain, bloating (“it’s annoying for performance, more like core performance
304 and impact of bloating” C3), reduced coordination and core strength (“it has an affect on core strength,
305 can’t hold myself in [to the wall] and being able to use core tension to move and sustain the movement to
306 hold it properly” C2) resulted in multiple female athletes either missing training or adjusting it to reduce
307 complex movements, reducing weights lifted or volume completed. One female athlete reported:

308 If I’m feeling rotten or low on motivation I’ll cut the session and move training to another day,
309 instead I will do something active but not very energy requiring. It’s all of the powerful stuff that
310 I’ll reduce down as I’m not as strong at that time because I’m not feeling it (C6).

311 There was increased discomfort completing specific techniques, for example in weightlifting the
312 bar hitting the lower abdomen when feeling bloated was reported to be uncomfortable “especially
313 snatch, if you’re bloated and snatch is in your hip crease and you smack yourself with the bar, it’s such an
314 uncomfortable thing” (W5). Medication was sometimes used to enable continuation of training from
315 physical symptoms of pain/cramps. Psychological and effective symptoms also impacted on training; “I
316 found it had a lot of effect on motivation and energy levels, or just being happy enough to go and climb,
317 because I’d be so worn down one week of the month I’d just be like, ‘I can’t do anything’ so I just wouldn’t
318 train”(C2).

319 Exercise requiring simple movement patterns with lower energy requirement were preferred with
320 reduced intensity “if you are experiencing symptoms, you’re much better off doing less technical, some
321 accessory work instead” (W5). However, if training was adjusted, athletes frequently reported to “make
322 up” these sessions on an alternative day, usually once menses had started because, “time before my
323 period impacts training and performance, once I’m on [menses] its just the inconvenience of bleeding”
324 (C6). Overall it appeared the athletes felt training was not impacted because they were able to change
325 the training; but they did not appear to realise that changing sessions does mean the menstrual cycle is
326 affecting training.

327 Some common themes from female athletes during competition where it did have an impact
328 were the anxiety of flooding/leaking whilst performing in a singlet or leotard and in some instances

329 caused a distraction or lack of confidence during competition “So you are always like ‘oh my god have I
330 leaked’ so the paranoia of leaking is horrible and distracts you” (W2), “it’s another thing to manage” (C4).
331 For one athlete this caused great frustration, sharing:

332 Just coming through [leaking] is the worst bit. We were doing a [bent over] row and I did a really
333 good one I was like dead on the floor, but I could see they were all looking at me and I thought
334 that was because I was doing a really good [bent over] row and then after I was like ah, ‘that’s
335 why they were looking at me’ [menses leaking] and it takes away from your performance. It was a
336 really good performance and people won’t remember that. I didn’t feel embarrassed I was just
337 angry (W1).

338 However, in some instances it was reported that some of athletes best performances were achieved
339 whilst bleeding, “I’ve actually had some of my best results competing on my period” (C6).

340 Climbing outside offered a different perspective, for some female athletes climbing high grades
341 outside was their performance requirement. For these athletes, they commented on the self-regulation of
342 when they are performing and therefore if they are experiencing pre-menstrual symptoms, they can opt
343 to not perform that day unlike pre-determined, organized competitions in other sports (unless external
344 factors of weather or travel were influential). Alternatively, climbing outside can be inconvenient when
345 experiencing menses as there are no toilets and facilities to change menstrual products or dispose of
346 them, which has influenced the choice of menstrual products used by these climbers. Participant C3
347 explained that being, “in the middle of nowhere on this new routing mission, filming as well and you’re
348 just like ‘oh this is not a good time, there were no bins, like nothing, no bins, no toilets, no showers. I was
349 just camping, and I was like oh God”. Climbers also reported feeling “less confident as well with climbing.
350 Like I’m definitely more in terms of the words coming out of my mouth, I’m like ‘I just can’t do it’” with
351 the element of risk and fear being more enhanced when experiencing pre-menstrual symptoms impacting
352 on performance.

353 **Coping (or not) with the menstrual cycle**

354 Participants have adopted different approaches and strategies to manage their menstrual cycle in
355 relation to training and competition when aware of the impact. Participants were more aware of the
356 impact of their cycle on competitions, with participants choosing one of two approaches to manage it;
357 acceptance or find ways to adapt. The approach to competition was either “just get on with it” as
358 demonstrated by one gymnast, “I always seem to be on during competitions so kind of used to it by now,
359 so many competitions that close together, it was inevitable that I was going to be on [menses] for some of
360 them” (G1). Or, athletes seek medical advice to prevent symptoms and/or bleeding using
361 contraceptives/pain killers;

362 I generally do six weeks on the pill then one week off, I want to limit the amount of times it
363 happens because I don't find it particular, it's not convenient and there's a lack of control
364 because of those negatives and I want to perform at sport, I would rather limit the amount of
365 time it [menses] happens (C4)

366 Athletes C5 and C6 all provided similar responses of, "I got used to it", "I kind of manage it
367 myself," and "I just kind of ignore it" but also displaying alternative feelings around, "it's annoying" and
368 "inconvenient" whilst a weightlifter shared, "silently suffering" and "deal with it...it's no one else's
369 problem, manage it anyway" (W2).

370 Participants indicated a lack of proactive approaches and knowledge of ways to manage their
371 menstrual cycle in relation to training and competition, with some athletes feeling like the options
372 available are very limited; "I don't want to take pills, so there's not much I can do about it" (C8). Only one
373 athlete (C6) reported alternative management strategies for competition; an increase in rest days were
374 taken in the week prior to menses to help with feelings of tiredness and also diet was adjusted increasing
375 iron intake the week prior, again to help her body best deal with menses if this coincided with
376 competition. Otherwise, management strategies for training and competition were related to adjustment
377 of training or seeking medical advice for pain killers or contraceptives. For example;

378 I used to get really bad cramps and I just couldn't do anything. But since I started taking Feminax
379 that's stopped that. So I don't really suffer them as bad now because I take medicine for it. And if
380 it happened on competition days, there was two competitions where I remember my period
381 fell...if it's the day I come on, I literally, I couldn't function at all. But that's not the case now (J1)

382 Some athletes opted to take contraceptives to prevent any distraction, if they were managing
383 menses in challenging environments, and wanting to control timing of withdraws bleeds, to have the
384 convenience of no bleeds at all or to control fluctuation in weight for weight making-sports "because of
385 the weight cut, being on contraception, there wasn't a change of increasing weight because I was due to
386 come on [menses] I didn't have to worry about losing and gaining weight" (W6). However, many females
387 felt they had received contradictive information from doctors or uncertainty in the advice provided on
388 contraceptives, resulting in frustration and doubt about the use of contraceptives as a management
389 strategy. One athlete commented, "no one even knows what half these contraceptives do and the impact
390 on hormones, symptoms and long-term side effects" (A1). This view was supported by several other
391 females and summarized by a climber:

392 I think especially when you're 17 you quite blindly just like, yeah that sounds great. But I do feel
393 that definitely from doctors when I've gone you get quite like one sided response and they don't
394 really acknowledge a lot of this sort of side of stuff. I've seen doctors when I've talked about the

395 different contraceptives that are available and I'm sometimes a bit disappointed with ... their lack
396 of, it's not even really compassion, it's like, just accepting contraception is actually relatively new
397 in the medical world, maybe there are long term side effects (C3).

398 Multiple females reported conversations with doctors discussing symptoms/side effects they
399 were experiencing, as a result of oral contraceptives, including feeling emotionally flat, headaches, or
400 excessively emotional, and being disappointed or questioning responses they received. For instance,
401 responses such as "it should settle down" which as one athlete reported, "3 months down the line and
402 I'm still bleeding continually" (C2). There was also concern regarding the long-term use of contraceptives
403 to control for factors associated with performance, as one climber testified:

404 Nobody has really said stop when I've gone for the check-ups and stuff and I've always asked is
405 this causing me a problem? And I usually get a fudgy answer. "Is there a reason not to be on
406 [contraception] for this long?" Nobody has really answered that, the guidance has been really
407 poor when I think about it, I've just made my own decisions and I go on instinct (C4)

408 Other than from personal perception, female athletes use their support network, predominately
409 peer conversations both in friendship groups and within sport to gain information from each other's
410 previous experiences which has impacted on decisions regarding how to manage their menstrual cycle,
411 especially relating to types of contraceptives and future choices which are made. Participant C2 discussed,
412 "Yeah, because my friend had got it [implant] and she'd hadn't had nothing [no bleeding]. She'd had it for
413 two years and she hadn't had any bleeding at all, and I was just like 'dream' not having a period at all
414 would be so much better for climbing." As well as gaining information, peer conversations were also
415 reassuring, "I have made really close friendships with who I would talk quite openly about it [menses].
416 How to manage it, which has been its refreshing to have someone else to talk about it [menses] with...it's
417 just a way to realise that we all have the same issues" (C4).

418 Within peer conversations, menstrual products also appear to be widely discussed and offer
419 different management strategies during menses. However, it was reported that information on menstrual
420 products is not openly shared when females initially receive information and support when starting their
421 menstrual cycle; the majority are provided with samples of pads rather than awareness of different
422 options available. Many females actively seek alternative options for training, competition, and
423 performance in different environments. One athlete explained, "Maybe six months after starting
424 [menarche] I started using tampons because I just thought that'll make a big difference in my sport if I can
425 just, you know it's a lot easier. And it's a lot easier to forget that its going on if you've got one of them
426 [tampon]" (C6). Meanwhile for climbing the discovery of a menstrual cup has been useful;

427 You had to change things [menstrual pads and tampons] all the time. But I started using a
428 menstrual cup for like a year now. And that's, you only change every 12 hours. It's great.
429 Sometimes if you're at a crag (outcrop of rock) it would have been a bit of a pain but now it's
430 much easier (C1).

431 Despite this, it can still be difficult to manage in some environments; with a climber highlighting "it was
432 kind of tricky camping. I was like how would I feel taking this [menstrual cup] out, clean it well enough and
433 be happy putting it back in when I'm camping and there's not even, I'm wild camping, there are no toilets
434 or running water" (C1).

435 Monitoring/tracking have been reported as a useful strategy for some athletes to increase self-
436 awareness of symptoms or identify within training if symptoms of the menstrual cycle negatively
437 impacted upon training "I started [monitoring] after I stopped taking the pill because I didn't know if I was
438 regular or know when I'm supposed to be on with weightlifting, it was really helpful to know if I am going
439 to be on [menses] before a competition and stop freaking out about weight as I can look back and be like
440 'oh that's okay it was the same last month and the month before" (W4). Awareness of symptoms and
441 impact on training and competition allowed for effective management strategies to be identified to
442 benefit performance.

443 **Openness of conversations**

444 Participants indicated that there was a lack of comfort or openness regarding talking about the
445 menstrual cycle, as one athlete shared:

446 There is just like this culture around not talking about it [menstrual cycle] and I think it's so weird,
447 it's so outdated, and is one of like the few areas where I think that there's a real kind of gender
448 imbalance still...this culture around women just getting on with it kind of thing and it's just
449 strange that in 2019 we're not talking about things [menstrual cycle] like this (C7).

450 Participants explained that their openness and comfort regarding such conversations was influenced by
451 their past experiences, particularly previous awkward conversations that may have occurred. A
452 weightlifter described, "he's [partner] always a little bit repulsed by the idea [of periods], and you think
453 well if he doesn't like the idea of talking about it then someone you're not as close to definitely doesn't
454 want to hear about it!" (W2). Climbers similarly shared concerns regarding awkwardness and concern for
455 others feelings, stating, "...if they're really awkward then it makes you feel more awkward" (C1), and "you
456 don't want to make them feel uncomfortable" (C2), which resulted in them limiting conversations about
457 the menstrual cycle.

458 Some participants indicated that they were more likely to have conversations about their
459 menstrual cycle if it was impacting on their performance. For instance, a weightlifter explained, "if it was

460 affecting me, I felt like it was affecting my performance, I would openly talk about it" (W4). However, in
461 such instances, participants indicated that they may still be selective about who they shared this
462 information with (e.g., certain coaches they were more comfortable with; "I'd choose a person that
463 wouldn't sort of say 'Oh God don't talk to me that's enough information" W4). In contrast, other
464 participants, such as one of the climbers, indicated that they would never discuss their menstrual cycle,
465 even if it was affecting their performance, "God no! No! I don't think I would ever have had that
466 conversation" (C2). When reflecting on why, she further explained:

467 I think that was the issue, being coached by men, because the guys I got coached by were quite
468 old-fashioned...he had no comprehension of the female body and how it would be affecting them,
469 I watched him tell girls off for being lazy when I knew that those girls were going through their
470 periods, he just couldn't comprehend there was more to it than them just being lazy.

471 Similar thoughts were shared by a weightlifter who explained, "it's not something you really want to tell
472 your coach, look I'm on my period today...I don't know, it's something about telling your male coach I'm
473 on my period that you don't really if you cannot tell as many people as possible you try not to don't you"
474 (W2). Many of the participating females suggested;

475 I think if you knew that male coaches were put in a room and just gave them a talk for an hour
476 about look, this might be what your lifters are experiencing that they don't want to tell you. That
477 would be helpful because then you don't necessarily have to have the detailed conversations with
478 them but say look this week it's going to be inconvenient" (W2).

479 Instead comments of "I am not feeling 100% today" were used to cope during training.

480 In comparison, participants indicated a higher degree of comfort speaking to other females, even
481 if they have not previously been coached or supported by the individual. As one weightlifter said, "I've
482 been on trips with female coaches and obviously you can go and talk to her, like 100% comfortable saying
483 I feel rubbish today because I'm on my period" (W2). Although, this comfort was still not consistent
484 across all participants, with a couple of females indicating a similar level of hesitancy to talk to female
485 coaches as to male. One athlete shared, "oh no, I wouldn't say anything...I just don't want to because it's
486 awkward" (G1). However, all participants indicated that they would talk to the medical team, irrespective
487 of whether it was a male or female doctor, because, as one participant explained, "that would be normal"
488 (G1).

489 Aside from increased comfort of speaking to females, participants indicated that positive
490 conversations, confidence, familiarity, and increasing age may also increase the openness or likelihood of
491 conversations regarding their menstrual cycle occurring. For instance, a climber shared, "I think when I
492 was younger it would have been awkward but now it's not so much...when I was younger I would never

493 have talked about this but now we just don't really care" (C1), while another climber explained, "I think
494 now when we're in a group where it's just the girls, we'll sit and complain about it...I think it's much more
495 a thing we've got the confidence for it but I don't know if that would be the case with all the other girls, I
496 think some people are quite reserved about it" (C2).

497 Additionally, participants explained that experiences such as talking to doctors about
498 contraception, having smear tests, or having the coil inserted, increased their confidence to talk about
499 their menstrual cycle and experiences more openly. Furthermore, participants' upbringing, specifically,
500 the frequency and openness of conversations about the menstrual cycle as they were growing up
501 appeared to influence subsequent conversations. As a climber explained, "I had a very open upbringing so
502 I think I've always been quite not bothered about talking about those kind of things" (C6), whereas
503 another climber conveyed limited conversations with family and peers and feelings of embarrassment
504 discussing this topic and identifying, "only when I've got comfortable with myself that I've had the
505 confidence to enter in to those conversations with people" (C4).

506 Overall, participants indicated that they would like to receive more knowledge on menstrual
507 cycles in relation to sport, to increase their comfort discussing it and for this also to be shared with
508 coaches. For instance, one weightlifter shared, "It's crazy because we've had loads of workshops about
509 diet and nutrition and like psychology and S&C and stretching and meetings with physios but something
510 that happens every month that you can't control, there's nothing" (W2). In fact, throughout the
511 interviews, it was apparent that a number of participants were unaware of the potential impact their
512 menstrual cycle might have, as a weightlifter explained, "I didn't even know it could affect performance"
513 (W2). With more knowledge and understanding, participants perceived they may talk more openly about
514 this topic, which they felt would be beneficial. One athlete summed up the views of many stating:

515 I think it just needs to be spoken about more with everyone so it doesn't like it's not a taboo
516 subject or people don't feel awkward about talking about things. People know where they can get
517 advice from if they need to get advice or people just become a little more aware so I think just
518 having more information out there and more opportunities to chat about it because information
519 is thin and everyone is an individual and it completely depends on where you are and time in your
520 life and what contraceptives you have. Like whether that's another athlete, a peer or support
521 team member or whatever it is I think just avenues need to be opened up more. People don't
522 want to say anything, don't want to be judged by it. But actually lots of people are in the same
523 boat and we've been given the same bad advice (A1).

524 **Discussion**

525 The purpose of this study was two-fold; to examine (a) elite female athletes' perceptions of the
526 menstrual cycle on training and performance and (b) explore openness of conversation pertaining to the
527 menstrual cycle with coaches and practitioners. The key intention was to engage with elite female
528 athletes to understand their experiences and individual variability in response to the menstrual cycle
529 alongside their comfort levels and experiences in having conversations with coaching and support staff.
530 Overall, the findings of this study highlighted the extensive influence the menstrual cycle may have on
531 training and competition performance in elite female athletes, the individual variability associated with
532 this and discrepancy in openness of conversation with female compared to male coaches and support
533 staff.

534 Previous research has made us aware of data relating to the perceived impact of the menstrual
535 cycle on sport performance; Bruinvels et al.⁷ identified 51.1% of elite British female runners and rowers
536 felt their menstrual cycle had in some way impacted upon their training and performance, Martin et al.²⁹
537 reported that 77% of elite athletes (n=430), not using hormonal contraception, had negative side-effects
538 during their menstrual cycle and Findlay et al.¹⁴ highlighted experiences of the menstrual cycle within elite
539 rugby. However, there was a need to understand individual perceptions and which aspects of the
540 menstrual cycle impacted on training and competition in individual and across multiple sports, as previous
541 research has been predominately large-scale survey based approaches with minimal qualitative elements
542 which allow individual responses to be addressed. This will help inform and influence best practice
543 provided by coaches and practitioners¹³. Also notable is the timing of when these symptoms were
544 experienced, for some elite female athletes the week prior to menses may have a greater impact in
545 comparison to some who may experience heightened symptoms once menses start. Consistent with our
546 findings, ratings of symptoms have increased during the premenstrual week and were maximal on the
547 days immediately preceding and following the onset of menstruation³⁰. It has been recognised the
548 menstrual cycle causes recurrent, moderate-to-severe affective, physical, and behavioural symptoms that
549 develop during the luteal phase and disappear within a few days of menstruation³⁰.

550 The current study has provided individual accounts of the perceived influence of the menstrual
551 cycle on training and performance. The ability of elite athletes to train due to adverse symptoms was a
552 prevalent feature; physical symptoms, including stomach cramps, lower back pain or bloating were the
553 predominant causes for training to be altered or missed. This is consistent with the results described by
554 Kishali et al.¹³, in which it was determined pain affects performance, further supported by Findlay et al.¹⁴
555 and Kin, Yegu & Illi³¹ reporting 70.87% of athletes indicated painful menstruation within their study.
556 Psychological and affective symptoms also were reported in our study, with feelings of lethargy,
557 decreased motivation and distraction being the most recurrent symptoms. These symptoms have been

558 noted in both the general public and an elite athletic population²⁹. These symptoms were recurrently
559 experienced earlier than physical symptoms and were not always recognized by the individual to be
560 related to their menstrual cycle, until the physical appearance of menses began when distraction also
561 became a more prominent factor. It is possible that individual's mood does consistently rise and fall over
562 the course of the menstrual cycle—but that the timing does not perfectly align across individuals³²
563 providing a strength of the individual accounts provided.

564 Frequently, within our study, female athletes reported their symptoms had no impact on training,
565 despite discussing adjusting or rearranging their training schedule as a consequence of symptoms
566 experienced throughout the menstrual cycle. In some instances, self-awareness of the impact of the
567 menstrual cycle and acknowledgement it has upon training was limited. Ignorance or more limited self-
568 awareness may be deemed to be beneficial by some participants, especially at competitions because it
569 prevented them from expecting to feel tired or not performing at their best at certain times in their cycle.
570 Lack of awareness of these symptoms and feelings could reduce the impact it has on competition,
571 preventing anxiety and worry of underperforming in elite athletes. However, having a self-awareness of
572 the menstrual cycle may help preparation and management of any negative symptoms. Alongside this,
573 factors such as making weight, in which awareness of weight gain in relation to the menstrual cycle may
574 reduce stress and anxiety at competition was frequently reported.

575 Several of the interviewed athletes within the current study reported worse pre-menstrual
576 symptoms when they were a teenager, reduced awareness, and also lower confidence to have open
577 conversations, highlighting the importance of providing information and promoting self awareness to
578 youth athletes improving management of premenstrual symptoms and menses. Therefore, there are both
579 consequences and benefits of increasing self-awareness of the menstrual cycle for females in elite sport.
580 Monitoring of symptoms and cycle length could be one strategy to increase self-awareness of the
581 menstrual cycle, but the potential for some athletes to become increasingly anxious, especially at
582 competition, as a result of being more aware of their menstrual cycle should be considered. It may be
583 important to identify management strategies in alignment with monitoring of symptoms to prevent this.

584 Having insight into individual variation in symptoms and perceived impact can increase the
585 understanding and inform best practice for coaches and practitioners working within elite sport. A key
586 aspect of the findings illustrates that one approach cannot be applied to all female athletes, whether this
587 is for symptoms and management, training, competition or increasing comfort and openness of
588 conversations. For example, only one athlete reported feeling increased muscle soreness and taking
589 longer to recover prior to menses, consistent with research by Hackney, Kallman & Aggon³³ evidencing
590 female sex hormone changes due to the menstrual cycle can affect the physiological responses during the

591 recovery period. For this individual an increased focus on recovery may be pertinent, ensuring training is
592 adapted accordingly. Identifying and understanding experiences of the individual elite female athlete
593 regarding her menstrual cycle symptoms and responses is key for coaches and practitioners to optimize
594 performance through evidence informed practice.

595 Previous research has been contrasting in relation to the physiological impact of the menstrual
596 cycle on sport performance and adaptation, however, as established from the current results this may be
597 due to the individual variability in timing of and symptoms experienced by each individual. The influence
598 of psychological determinants such as motivation and levels of lethargy should also be considered
599 throughout the cycle in relation to performance, as stated by multiple female athletes within this study;
600 this has not previously been considered within the literature yet we know the impact of motivation on
601 performance, those athletes who display high motivational profiles have been shown to obtain the
602 highest levels of performance³⁴.

603 Psychological determinants also commonly refer to changes in mood, but similarly to the
604 previously reported studies, most studies have presented averaged reports of mood across days that fall
605 into a defined phase. However, given that healthy individuals exhibit considerable variability in cycle
606 length, day of ovulation, and hormonal patterns³⁵, it is unlikely that these set phases capture the same
607 biological phenomenon across individuals. Instead it is important to identify individual differences, as
608 previously reported, to account for up to 16% of variance in mood symptoms³². Other researchers have
609 similarly found that individual patterns of change across the menstrual cycle are more reliable in
610 predicting significant discrepancies than attempts to fit people to an “average” pattern of change³⁶.
611 Within our study, unlike physical symptoms, not all females reported affective and psychological
612 symptoms. Some individuals reported changes in mood across different time frames and severity was
613 also variable. For instance, one female shared ‘one month one thing will happen, the next month
614 something else will happen’. Therefore these symptoms are not only variable between individuals but
615 also within the same individual month to month. Comments including ‘rather watch TV and eat
616 chocolate’ rather than go training highlight mood and motivational changes experienced in elite female
617 athletes.

618 One consistently reported element was the distraction of leaking or blood showing through
619 clothes especially at competition, which was consistent across all sports, irrespective of competition
620 clothing which ranged from singlets, leotards, shorts and a white gi. This aligns with previous findings in
621 which the trauma of staining clothing or leaking through underwear was deemed the most embarrassing
622 event that could happen while menstruating^{4,14}. This is an element which should be addressed within

623 sport, providing athletes advice on menstrual products available and consideration of clothes females are
624 required to wear for competition.

625 Coping strategies utilised by the participants in the current study were predominately limited to
626 contraceptives or analgesic and anti-inflammatory medication to adapt and manage symptoms impacting
627 on training and performance otherwise an acceptance 'get on with it' approach was observed. Most
628 reported coping strategies were used to control the timing of menstruation, to be able to control this in
629 relation to competition performances, to prevent the onset of symptoms or the inconvenience of
630 bleeding and associated anxiety or distraction of leaking whilst performing. This was consistent except for
631 climbers in which controlling the menstrual cycle was more useful when in locations without any toilet
632 facilities and concerns of poor hygiene. Despite perception of limited options 'I don't want to take pills, so
633 there is not much I can do', other management strategies are available. O'Brien et al¹⁰ highlighted non-
634 drug-based treatments including education, relaxation techniques, regular aerobic exercise and
635 nutritional supplements. Within the present study, individual athletes discussed some additional coping
636 strategies such as use of heat for pain management, only one athlete highlighted increasing rest pre-
637 competition if this coincided with pre-menstrual symptoms of decreased energy levels and increased
638 lethargy to optimize performance. This may be related to a heightened self-awareness. Elite female
639 athlete education on coping strategies is recommended to help reduce symptoms and impact on training
640 and performance, this coincides with one athlete sharing she had received "loads of workshops about diet
641 and nutrition and like psychology and S&C and stretching and meetings with physios but something that
642 happens every month that you can't control, there's nothing". Currently, there is often a lack of support
643 for many elite female athletes in relation to their menstrual cycle compared to other areas of sport
644 science which requires attention due to the impact on health, wellbeing and performance.

645 The current findings provide some intriguing insights into individual- and group- factors that
646 relate to the openness of conversation about the menstrual cycle. Many athletes indicated an openness
647 to talk about the menstrual cycle to female support staff, however great variation in the comfort athletes
648 felt regarding talking to male coaches irrespective of duration of the relationship between the coach and
649 athlete was evident. This is consistent with recent findings in female team sport, many athletes referred
650 to staff gender when considering who they would feel comfortable approaching in relation to menstrual
651 cycle issues. It was acknowledged that previously, female staff members had approached athletes and
652 initiated discussions on menstrual cycle management prior to a major event, and having a female doctor
653 reduced the unease surrounding the subject¹⁴. Others noted the unease at having menstrual cycle
654 conversations with male support staff¹⁴. Also, female athletes in the current study shared the opinion of
655 an outdated culture not talking about the menstrual cycle and questioning the reasoning for this.

656 Perceptions were displayed that males 'don't get it' or are awkward talking about the menstrual cycle.
657 This is supported by previous research highlighting male coaches, compared to female coaches reported it
658 was less important to ask athletes about menstrual irregularity, being less comfortable communicating
659 with female athletes about the topic¹⁸. However, within this research 'high knowledge coaches' in relation
660 to the menstrual cycle, were more likely than 'low knowledge coaches' to discuss the female athlete triad
661 irrespective of gender¹⁸. Despite the current study not investigating coaching perceptions of openness of
662 conversation, as this was beyond the scope of the study, the current results in combination with previous
663 research highlight future support is required to change perceptions to improve conversations held about
664 the menstrual cycle in relation to sport performance. This could be essential in sport as the IOC have
665 released figures that at Rio Olympics 11% of accredited coaches were female yet in 2020 it is estimated
666 that 48.8% of athletes will be female³⁷.

667 There is a need to action and increase the conversations of elite female athletes talking to male
668 coaches or practitioners about the impact their menstrual cycle can have on training and competition
669 performance. This is pertinent as research highlights that coaches are in a strong position to support their
670 athletes' development if they know them well³⁸. Jowett³⁹ states that communication is an important
671 unifying relational component; a key factor to successful outcomes in coaching. Communication promotes
672 the development of shared knowledge and understanding about various issues (e.g. goals, beliefs,
673 opinions, values) and forms the basis for initiating, maintaining, and terminating the coach-athlete
674 relationship⁴⁰. Open channels of communication enable the majority of the coach-athlete relationships
675 examined to establish co-oriented views as shared knowledge and understanding³⁸. Understanding each
676 other's position leads to effective interactions in both training and competition³⁸. Open communication
677 pertaining to the menstrual cycle, sharing knowledge and understanding, may be an important aspect to
678 enhance athlete-coach relationships and impact on performance. Furthermore, if menstruation was
679 discussed more openly, it might be easier for girls and women to acknowledge the positive aspects and
680 understand the physiology to positively impact training and performance.

681 Improving both athlete and coach knowledge and providing education on the menstrual cycle,
682 correct terminology, constructing positive conversations and changing the perception of awkwardness
683 could significantly reduce the discomfort and outdated nature of not having conversations relating to the
684 menstrual cycle. Irrespective of coach knowledge, within the current study, female athletes perceived
685 comfort of conversation would improve if coaches received education about the menstrual cycle.
686 Improving coach knowledge of the menstrual cycle, how to have positive conversations and insight into
687 what individual female athletes may be experiencing was raised as a factor within individual interviews to
688 help improve the openness and comfort of having conversations pertaining to the menstrual cycle.

689 Teaching basic facts about the menstrual cycle is a chance to correct misconceptions and misinformation
690 learned, and show the power of culture and social cognition on something as basic as a physiological
691 process². This may contribute to improving male coaches' ability to respond on a more individual basis to
692 their athletes along the lines of gender¹⁹, overcoming male coaches adjusting their practices to the
693 detriment of their female athletes based upon erroneous and unequal ideas of females as performers²⁰.
694 Previous experiences and perceptions of male awkwardness or lack of knowledge reduced the comfort of
695 female athletes speaking openly and sharing experiences with male coaches and practitioners; a
696 determinant which needs to be resolved. Research has stated educational materials for coaches should
697 provide strategies for male coaches to comfortably and sensitively address issues relating to menstrual
698 health among their female athletes. Indeed Kroshus et al.¹⁸ reported that coaches wanted to learn more
699 about health issues relevant to female athletes, including sports nutrition (88%), strength training and
700 female athletes (72%) and menstrual function.

701 **Applied Implications and future research direction**

702 The current findings detailing the perception and openness of conversation relating to the
703 menstrual cycle offer potentially important and previously unreported contributions to the literature. In
704 addition, our discussions with participants regarding information they would find useful to know in
705 relation to the menstrual cycle and sports performance can provide applied implications to provide future
706 direction and best practice for female athletes. As highlighted in the results, information requested from
707 elite athletes within our study can be grouped into five key areas; 1) contraceptives including side effects,
708 long term health impact and effect on training; 2) menstrual products; what options are there and any
709 products which are preferential for different sports; 3) how the menstrual cycle can affect training and
710 competition and management strategies for these; 4) coach education; improving awareness and
711 understanding and 5) Information for youth athletes and opportunities/advice of who to talk to.
712 Monitoring of the menstrual cycle may be advisable to elite female athletes to increase self-awareness
713 and better understand symptoms which are related to the menstrual cycle which may lead to identifying
714 positive management strategies. Continued education and workshops for athletes, coaches and support
715 staff is warranted to increase awareness of symptoms and strategies and may positively contribute to
716 optimizing training and performance of female athletes, ensuring an ongoing process and not just a one-
717 off talk⁴. This may be particularly important for younger females who may not be managing their
718 menstrual cycle effectively. Research has stated females have identified the internet as an important
719 educational source when it came to menstruation and should be a consideration for further education for
720 elite female athletes⁴. Alongside being used to find out about the menstrual cycle and alternative
721 menstrual products, the internet has been used as a platform for monitoring symptoms and attempting to

722 challenge traditional norms about menstruation⁴. This requires further investigation and whether this is
723 the best approach for coaches and elite female athletes.

724 The above recommendations could enhance elite female athlete support and enhance long-term
725 health, wellbeing and performance alongside providing direction for future research areas. In the first
726 instance, increasing the openness and comfort of conversation about the menstrual cycle should be a
727 priority for athletes, coaches and practitioners. This research should also be expanded to other
728 populations, extending geographical and cultural insight including the interaction of gender role and
729 identity as this was beyond the scope of the current paper.

730 **Limitations**

731 Limitations of the study should be considered, for the first aim of the study, all athletes were elite/senior
732 level and did not capture perception and experiences of junior athletes which may vary in symptoms,
733 impact on training and performance and comfort of conversations. A large proportion of the sample were
734 climbers, which is not representative of more popular, traditional female sports (e.g., swimming, tennis,
735 netball). However, despite this, the results were consistent across sports in most regards excluding the
736 outside environment of climbing and aligned with findings reported by Findlay et al.¹⁴ in female rugby
737 players. Only one interview was completed with each individual, additional interviews may have
738 increased comfort of conversations for some individuals and enhanced the depth of discussion collected.
739 In some instances it was the first time the female had openly discussed their menstrual cycle, this may
740 have influenced the quality of information collected alongside the different times of the menstrual cycle
741 when interviews were completed which may have provided different responses due to recall error and
742 symptoms being experienced at the time of interview. Relating to the second aim of openness of
743 conversation, there may be a bias in the sample in which athletes who were interviewed participated
744 because they were comfortable talking openly about the menstrual cycle and may miss the perceptions of
745 those that remain uncomfortable being involved in these conversations. A questionnaire associated with
746 discomfort and openness of conversation pertaining to the menstrual cycle may better address this
747 question. In conjunction, coaches' perceptions of comfort of conversation were not collected within this
748 study, which may influence communication between the coach and athlete. However, as females
749 perceived an awkwardness of male coaches in conversation these perceptions should be considered in
750 addition to the other factors identified influencing conversation (age, previous conversations, experience
751 and familiarity with the person). It may be important for coaches to be aware of the perceptions and
752 other influencing factors when approaching the conversation about the menstrual cycle with elite female
753 athletes. Future research should be completed within this area to identify perceptions and experiences of

754 coaches talking to females athletes about the menstrual cycle when considering training and
755 performance.

756 **Conclusion**

757 In summary, it is important to change any negative perceptions as the menstrual cycle is a normal
758 bodily function and physiological process which can impact on training and performance due to the high
759 prevalence of symptoms experienced. Elite female athletes' experiences varied greatly between
760 individuals, however many reported physical symptoms as well as mood disturbances and reduced
761 motivation to train. They sometimes sought to minimize training intensity and load. The decision to
762 actively control their menstrual cycle was often triggered by a desire to reduce the effect on competition,
763 particularly given that athletes were anxious about making their required weight in some sports or
764 distraction of leaking and blood showing through clothes. Athletes indicated an openness to talk about
765 the menstrual cycle to female support staff, however, there was great variation in the comfort athletes
766 felt regarding talking to male coaches. This was independent to the duration of the athlete and coach
767 relationship and in some instances linking to uncomfortable conversations experienced at a younger age
768 in school or sport. From an early age, females receive messages to hide their periods and this is a
769 perception that requires change in order to allow the positive aspects of menstruation to be identified
770 and openly talk to maximize sport performance. Considering how to promote an environment of open
771 discussion and establishing procedures for elite female athletes to identify known points of contact are
772 important to increase the opportunity to talk about the menstrual cycle and impact on health, training
773 and performance.

774 **Perspective**

775 Females are exposed to messages from a young age to hide their menstrual cycle, reinforced by
776 media forms using allegorical images to promote secrecy. As a result, the confidence and comfort of
777 females having conversations in relation to the menstrual cycle is affected. Our results highlight elite
778 female athletes experience physical, affective and psychological symptoms before and during menses
779 which impact upon the ability to complete training sessions, either adjusting or rearranging them. This is
780 alongside increased anxiety and distraction whilst at competition affecting performance. The menstrual
781 cycle is a biological process, impacted by health and wellbeing and having the ability to both positively
782 and negatively impact on performance. Therefore it should be considered equally and discussed when
783 necessary alongside other performance determinants in sport, with the absence of feelings of
784 embarrassment or awkwardness during the conversations.

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Table 1: Participant demographics

Participant age (yrs)	Sport	Gender of coach	Abbreviation
18	Weightlifting	Female	W1
26	Weightlifting	Male	W2
19	Weightlifting	Male	W3
25	Weightlifting	Male	W4
28	Weightlifting	Male	W5
26	Weightlifting	Male	W6
28	Athletics	Male	A1
29	Climbing	Male	C1
23	Climbing	Male	C2
28	Climbing	Male	C3
34	Climbing	Male	C4
32	Climbing	Male	C5
17	Climbing	Male	C6
28	Climbing	Male	C7
24	Climbing	Male	C8
21	Gymnastics	Female	G1
28	Judo	Male	J1

Table 2: Themes

Overarching Theme	Sub-themes
Symptoms	Physical, affective and psychological Change with age Contraceptives
Impact on training and competition	Training awareness Training alteration Competition acceptance Competition medical intervention Competition distraction
Coping (or not) strategies	Support Management Mentality
Openness of conversation	Coach gender External factors

Table 3: Menstrual cycle status characteristics

Menstrual cycle history	
Mean age at menarche (years)	13±1.7
Mean frequency of menses (days)	30.6±4.2
Mean duration of menses (days)	4.75±1.1
Heavy menstrual bleeding	1
Athletes tracking their menstrual cycle	9
Hormonal contraceptive history	
Currently using hormonal contraceptives	5 athletes
Type of contraceptive used	Combined pill; n=1 Implant; n=1 Mirena coil; n=2 Mini pill; n=1
Previous use of hormonal contraceptives	3 athletes

Table 4: Reported physical symptoms

Symptoms

Pain/cramps	Weight gain
Heavy bleeding	Sleep disturbance
Bloating	Poor temperature regulation
Sick/nauseous	Tiredness
Low energy/lethargic	Change in breast size
Uncoordinated	Ill/cold symptoms
Bad skin	Headache
Fainting	Dizziness
Lower back pain	Gastrointestinal disturbance
