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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

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

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

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

Introduction

The female reproductive life cycle is one of the most important biological rhythms¹ with the menstrual cycle being a perfect example of a bio-psycho-social process; it is a normal aspect of physiology that both affects and is affected by behaviour². However, research has shown that many females feel advice and information they receive is focussed on the biology of menstruation and suggest this should be shifted to personal, subjective and lived experiences³. The literature to date

27 has concentrated on the biological process involved in the menstrual cycle, with emerging research
28 on the impact of sport performance, yet personal and lived experiences have infrequently been
29 investigated. This may result from menstruation remaining a hidden topic, rarely spoken about and
30 also considered a topic of shame and embarrassment⁴. Reports have highlighted menstrual stigma
31 still existing and considered an educational and socio-economic issue across the world; a survey
32 identified 1 in 4 girls did not feel they knew what to do when they started their period, with 48% of
33 girls feeling embarrassed by their period⁴. Despite a number of international campaigns focusing on
34 breaking down the stigma, this still exists within sport and wider society.

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

44 The menstrual cycle is the result of the actions of the hypothalamic, hypophyseal and ovarian
45 hormones bringing about various changes in the female reproductive system as well as many other
46 tissues of the body¹. The menstrual cycle encompasses two main phases associated with fluctuating
47 levels of hormones, the follicular phase and the luteal phase. Besides from reproductive function,
48 female sex hormones are known to affect numerous other cardiovascular, respiratory,
49 thermoregulatory and metabolic parameters⁶. Therefore, at each stage of the menstrual cycle,
50 throughout a cycling month, it can theoretically affect sporting performance in different ways.
51 However, the effects of the menstrual cycle (and the associated hormonal fluctuations) on sporting
52 performance have largely been unaccounted⁷. And whilst more studies are starting to emerge, there

53 are still many questions with indefinite answers. Further disparity exists when considering
54 contraceptives. With the primary aim to prevent pregnancy, the change in physiology resulting from
55 exogenous hormones may affect sporting performance⁸. The literature is confounded by the
56 complexity in the various contraceptive types, containing differing levels of hormones; some are
57 oestrogen and progestin (combined pill), whereas others contain progestin only (mini pill, implant,
58 mirena coil, injection). The different forms of contraceptives can result in the prevention or increase
59 in symptoms experienced by female athletes⁸.

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

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

78 influence best practice and optimise support provided by coaches and practitioners to resolve issues
79 relating to health, wellbeing and sporting performance¹³.

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

99 The communication taboo is supported by the existence of dozens of euphemisms for
100 menstruation. If there was an open environment to talk about menstrual blood there would be no
101 reason to call it anything other than menstruation or menses¹⁷. Within elite team sport, one study
102 identified that some athletes have expressed a reluctance to confide in their coaches relating to the
103 menstrual cycle due to reported awkwardness, embarrassment, gender differences and feeling like

104 there would be nothing that the coach could do to help them¹⁴. Communication is a fundamental part
105 of coaching, yet when focussing on the menstrual cycle, previous research has highlighted male
106 coaches, compared to female coaches, reported it was less important to ask athletes about menstrual
107 irregularity, being less comfortable communicating with female athletes about the topic¹⁸. Female
108 athletes in high performance sport are more likely to have a male coach, therefore research has
109 questioned whether coaches are sufficiently prepared to respond on a more individual basis to their
110 athletes along the lines of gender¹⁹. Male coaches may adjust their coaching practices to the
111 detriment of their female athletes²⁰. Furthermore, previous research has highlighted, coaches of elite
112 athletes are expected to coordinate the communication between the different members of the
113 support team and to plan and prepare for long-term development and participation in elite
114 competition. This requires communicating with people to optimize performance within a mindful
115 environment²¹; the absence of communication between coach and athletes pertaining to the
116 menstrual cycle may have a consequential impact on sport performance. The impact of (unequal)
117 gender relations and the significance of gendered ideas and expectations may currently influence the
118 effectiveness of coach–athlete relationships²⁰. Fundamentaly, Johnston-Robledo & Chrisler¹⁵
119 commented, if menstruation were discussed more openly, it might be easier for girls and women to
120 acknowledge the positive aspects of menstruation.

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

127 1) Elite female athletes' experiences of their menstrual cycle, with a specific focus upon the
128 perceived impact it has on training and competition performance.

129 2) The openness of conversation pertaining to the menstrual cycle with coaching and support
130 staff.

131 **Method**

132 To address the aims of this study and facilitate an in-depth understanding of elite female
133 athletes' experiences, a qualitative descriptive study^{22,23}. Interpretive descriptive studies seek to gain
134 in-depth insights from participants pertaining to their experiences, while producing descriptive
135 accounts that remain close to the participants words and produce insights that may be useful in
136 practice. Given the aim of this study was to produce data that could stimulate and encourage
137 conversations among athletes, this approach was deemed particularly valuable. Such studies generally
138 use a combination of purposive sampling, data collection through unstructured or semi-structured
139 interviews, and a variant of qualitative content analysis^{22,23}. As such, these approaches to data
140 collection and analysis methods were used within the current study.

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

150 **Participants**

151 Seventeen elite female athletes (age 25.5 ± 4.7) from a range of sports (Table 1) were
152 purposefully sampled based on (a) sex (biologically menstruating females), (b) identifying as female,
153 (c) their level of competition experience and (d) the length of time participating and competing in their
154 sport. It is important to note sex versus gender differences; sex describes biological differences

155 including genetic, hormonal and physiological factors in comparison to describing gender, in which
 156 social constructs interact²⁵. It has been acknowledged that not all people who were assigned female
 157 at birth, or who identify as female, menstruate. Conversely, there are people who identify as genders
 158 other than female (such as transgender, intersex and non-binary people) who also menstruate⁴. For
 159 this reason, and the focus of the current study, both biologically menstruating and identifying as
 160 female were inclusion criteria for this study.

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

170 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

171

172 **Procedure**

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

191 The final interview guide started with introductory questions, followed by main questions and
192 finished with requested information from female athletes. Introductory questions sought to identify
193 demographic information such as age, duration and level of involvement within their sport.
194 Participants were then asked main questions about their lived experiences of the menstrual cycle, if
195 and how this had changed with age and perception of the menstrual cycle in relation to their training
196 requirements and competitions. This progressed onto openness of conversations about their
197 menstrual cycle with coaches and individuals within their support network. Following this, participants

198 were given the opportunity to request any information or support they had questions about or felt
199 lacked knowledge on in relation to their menstrual cycle (See Appendix A). Following introductions
200 and discussions regarding the purpose of the study, all interviews lasted between 34.1 and 62.5 min
201 (M = 47.1 min). The first author was responsible for conducting all interviews due to familiarity
202 established whilst working within their sports and training environment. Through such engagement,
203 the first author gained a greater understanding of the individuals sporting context and environment
204 which facilitated the development of rapport with the participants and aided understanding of the
205 experiences they were describing. It was hoped that the participants would feel more comfortable
206 and openly discuss their thoughts and experiences relating to the menstrual cycle. The first author's
207 background is also worth noting, working in sport science, as well as personal experience of sports
208 such as climbing, helped relate and further understand experiences described.

209 **Data Analysis**

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

218 **Methodological rigour**

219 Techniques were conducted during and following analysis to enhance the rigor of data
220 analysis. First, the results were produced by researchers working as a team, the second author
221 questioned the analysis and asked for explanations and justifications for the codes produced. The next
222 analytic step involved the second author, questioning raw data themes, this resulted in some
223 reorganization of the grouping of the themes but not of the coding itself. This was repeated by the

224 third author. The final phase of analysis was the writing of the results section because writing is viewed
225 as part of the analysis in qualitative research²⁸. The final results, which are presented below, were
226 evaluated, discussed, and agreed upon by all three members of the research team. Although the basic
227 themes remained the same, the written presentation of these themes went through several iterations
228 before the final representation of the results was agreed upon. Credibility and transparency were
229 sought through pilot interviews, engagement with individuals within each sport and detailed
230 interviews to gain broader insights beyond the interview data. Maintaining the same interviewer
231 ensured the nature of the interview, and in particular the delivery of questions was kept relatively
232 constant across all female athletes.

233 **Results**

234 Elite female athletes discussed a range of factors related to the menstrual cycle, although, in
235 some instances there was limited awareness of the impact the menstrual cycle may have on sport
236 performance. Despite the somewhat limited awareness, all female athletes reported symptoms
237 associated with the menstrual cycle which affected training more so than competition. Conversations
238 with coaches and support staff varied between athletes, with experiences of previous awkward
239 conversations influencing comfort and openness to future conversations. Overall, a word document
240 of approximately 111,613 words of transcribed text was analysed. Through analysis, 13 sub-themes
241 and four main themes were developed; (a) symptoms experienced, (b) menstrual cycle impact on
242 training and competition, (c) coping (or not) strategies of the menstrual cycle and (d) openness of
243 conversations (Table 2); each of these are discussed below. Descriptive menstrual cycle data and
244 hormonal contraceptive use are displayed in table 3; five athletes reported to be currently using a
245 form of hormonal contraceptive (29%). Across all females, 71% of female athletes reported
246 experiencing abdominal cramps, other symptoms of bloating (65% reported) and agitated/irritability
247 (59%) were the next most commonly reported symptoms associated with the menstrual cycle.
248 Furthermore, female athletes discussed information they deemed valuable to receive about the
249 menstrual cycle to improve knowledge and awareness which was grouped into 5 key areas; 1)

250 contraceptives including side effects, long term health impact and effect on training; 2) menstrual
 251 products, what options are there and any products which are preferential for different sports; 3) how
 252 the menstrual cycle can affect training and competition and management strategies for these; 4)
 253 coach education, improving awareness and understanding and 5) information for younger athletes
 254 and opportunities/advice of who to talk to.

255 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

256

257 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

258

259

260 **Symptoms**

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

275 All females reported experiencing at least two of the physical symptoms listed in Table 4 with
276 the most common being cramps/pain (71%). In contrast, not all athletes reported affective and
277 psychological symptoms; those reported included increased worry, unusually stressed, easily
278 frustrated, reduced motivation to train, disengaged, moody, agitated/irrational, reduced confidence,
279 depressed, and increased emotion (crying). Awareness of these symptoms appeared to be more
280 variable and were frequently recognized in older athletes who had a menstrual cycle for a longer time.
281 Variability of symptoms from one cycle to the next was expressed by some participants; “one month
282 one thing will happen, the next month something else will happen...it makes it difficult to be aware
283 and have conversations as its difficult to explain” (A1).

284

285

286 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

287

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

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

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

303 Other females reported different side effects; for instance, a weightlifter identified she was more
 304 emotional, had continual bleeding, dermatological issues, and food craving resulting in no longer
 305 taking a contraceptive pill “because [I was] emotional it was completely ruining my training” (W4).
 306 Meanwhile other athletes reported associated symptoms of headaches, incredibly painful periods,

307 and concern about the long-term effects of very low hormone levels “I think my cramps are a bit worse
308 but I don’t get the headaches any more, that is why I came off the pill because of the headaches, well
309 side effects really” (C1).

310 **Impact on training and competition**

311 The symptoms associated with the menstrual cycle impacted on athletes during both training
312 and competition. Athletes’ perception of the impact of the menstrual cycle on performance varied
313 and, in some instances, athletes lacked awareness of how it may impact “I didn’t even know it could
314 affect your performance, it never crossed my mind when I was younger” (W5). For instance, many of
315 the athletes initially reported no impact of their symptoms on training, yet the majority followed up
316 with statements such as their menses/pre-menstrual syndrome symptoms left them feeling “out of
317 action”, “feel rubbish” and “sluggish during training”. As the interviews evolved, an impact on training
318 became more notable, with a large proportion of participants reporting feeling slower and lethargic
319 during training, often lacking motivation to go in the first place as one weightlifter summarized, “I’d
320 rather eat chocolate and watch TV on the sofa” (W2).

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

326 One female athlete reported:

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

330 There was increased discomfort completing specific techniques, for example in weightlifting
331 the bar hitting the lower abdomen when feeling bloated was reported to be uncomfortable “especially
332 snatch, if you’re bloated and snatch is in your hip crease and you smack yourself with the bar, it’s such

333 an uncomfortable thing” (W5). Medication was sometimes used to enable continuation of training
334 from physical symptoms of pain/cramps. Psychological and effective symptoms also impacted on
335 training; “I found it had a lot of effect on motivation and energy levels, or just being happy enough to
336 go and climb, because I’d be so worn down one week of the month I’d just be like, ‘I can’t do anything’
337 so I just wouldn’t train”(C2).

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

346 Some common themes from female athletes during competition where it did have an impact
347 were the anxiety of flooding/leaking whilst performing in a singlet or leotard and in some instances
348 caused a distraction or lack of confidence during competition “So you are always like ‘oh my god have
349 I leaked’ so the paranoia of leaking is horrible and distracts you” (W2), “it’s another thing to manage”
350 (C4). For one athlete this caused great frustration, sharing:

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

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

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

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

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

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

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

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

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

402 Some athletes opted to take contraceptives to prevent any distraction, if they were managing
403 menses in challenging environments, and wanting to control timing of withdraws bleeds, to have the
404 convenience of no bleeds at all or to control fluctuation in weight for weight making-sports "because
405 of the weight cut, being on contraception, there wasn't a change of increasing weight because I was
406 due to come on [menses] I didn't have to worry about losing and gaining weight" (W6). However,
407 many females felt they had received contradictive information from doctors or uncertainty in the
408 advice provided on contraceptives, resulting in frustration and doubt about the use of contraceptives
409 as a management strategy. One athlete commented, "no one even knows what half these

410 contraceptives do and the impact on hormones, symptoms and long-term side effects" (A1). This view
411 was supported by several other females and summarized by a climber:

412 I think especially when you're 17 you quite blindly just like, yeah that sounds great. But I do
413 feel that definitely from doctors when I've gone you get quite like one sided response and
414 they don't really acknowledge a lot of this sort of side of stuff. I've seen doctors when I've
415 talked about the different contraceptives that are available and I'm sometimes a bit
416 disappointed with ... their lack of, it's not even really compassion, it's like, just accepting
417 contraception is actually relatively new in the medical world, maybe there are long term side
418 effects (C3).

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

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

429 Other than from personal perception, female athletes use their support network,
430 predominately peer conversations both in friendship groups and within sport to gain information from
431 each other's previous experiences which has impacted on decisions regarding how to manage their
432 menstrual cycle, especially relating to types of contraceptives and future choices which are made.
433 Participant C2 discussed, "Yeah, because my friend had got it [implant] and she'd hadn't had nothing
434 [no bleeding]. She'd had it for two years and she hadn't had any bleeding at all, and I was just like
435 'dream' not having a period at all would be so much better for climbing." As well as gaining

436 information, peer conversations were also reassuring, “I have made really close friendships with who
437 I would talk quite openly about it [menses]. How to manage it, which has been its refreshing to have
438 someone else to talk about it [menses] with...it’s just a way to realise that we all have the same issues”
439 (C4).

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

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

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

458 Monitoring/tracking have been reported as a useful strategy for some athletes to increase
459 self-awareness of symptoms or identify within training if symptoms of the menstrual cycle negatively
460 impacted upon training “I started [monitoring] after I stopped taking the pill because I didn’t know if
461 I was regular or know when I’m supposed to be on with weightlifting, it was really helpful to know if I

462 am going to be on [menses] before a competition and stop freaking out about weight as I can look
463 back and be like 'oh that's okay it was the same last month and the month before" (W4). Awareness
464 of symptoms and impact on training and competition allowed for effective management strategies to
465 be identified to benefit performance.

466 **Openness of conversations**

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

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

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

481 Some participants indicated that they were more likely to have conversations about their
482 menstrual cycle if it was impacting on their performance. For instance, a weightlifter explained, "if it
483 was affecting me, I felt like it was affecting my performance, I would openly talk about it" (W4).
484 However, in such instances, participants indicated that they may still be selective about who they
485 shared this information with (e.g., certain coaches they were more comfortable with; "I'd choose a
486 person that wouldn't sort of say 'Oh God don't talk to me that's enough information" W4). In contrast,
487 other participants, such as one of the climbers, indicated that they would never discuss their

488 menstrual cycle, even if it was affecting their performance, “God no! No! I don’t think I would ever
489 have had that conversation” (C2). When reflecting on why, she further explained:

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

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

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

503 Instead comments of “I am not feeling 100% today” were used to cope during training.

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

513 Aside from increased comfort of speaking to females, participants indicated that positive
514 conversations, confidence, familiarity, and increasing age may also increase the openness or likelihood
515 of conversations regarding their menstrual cycle occurring. For instance, a climber shared, “I think
516 when I was younger it would have been awkward but now it’s not so much...when I was younger I
517 would never have talked about this but now we just don’t really care” (C1), while another climber
518 explained, “I think now when we’re in a group where it’s just the girls, we’ll sit and complain about
519 it...I think it’s much more a thing we’ve got the confidence for it but I don’t know if that would be the
520 case with all the other girls, I think some people are quite reserved about it” (C2).

521 Additionally, participants explained that experiences such as talking to doctors about
522 contraception, having smear tests, or having the coil inserted, increased their confidence to talk about
523 their menstrual cycle and experiences more openly. Furthermore, participants’ upbringing,
524 specifically, the frequency and openness of conversations about the menstrual cycle as they were
525 growing up appeared to influence subsequent conversations. As a climber explained, “I had a very
526 open upbringing so I think I’ve always been quite not bothered about talking about those kind of
527 things” (C6), whereas another climber conveyed limited conversations with family and peers and
528 feelings of embarrassment discussing this topic and identifying, “only when I’ve got comfortable with
529 myself that I’ve had the confidence to enter in to those conversations with people” (C4).

530 Overall, participants indicated that they would like to receive more knowledge on menstrual
531 cycles in relation to sport, to increase their comfort discussing it and for this also to be shared with
532 coaches. For instance, one weightlifter shared, “It’s crazy because we’ve had loads of workshops about
533 diet and nutrition and like psychology and S&C and stretching and meetings with physios but
534 something that happens every month that you can’t control, there’s nothing” (W2). In fact,
535 throughout the interviews, it was apparent that a number of participants were unaware of the
536 potential impact their menstrual cycle might have, as a weightlifter explained, “I didn’t even know it
537 could affect performance” (W2). With more knowledge and understanding, participants perceived

538 they may talk more openly about this topic, which they felt would be beneficial. One athlete summed
539 up the views of many stating:

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

549 **Discussion**

550 The purpose of this study was two-fold; to examine (a) elite female athletes' perceptions of
551 the menstrual cycle on training and performance and (b) explore openness of conversation pertaining
552 to the menstrual cycle with coaches and practitioners. The key intention was to engage with elite
553 female athletes to understand their experiences and individual variability in response to the menstrual
554 cycle alongside their comfort levels and experiences in having conversations with coaching and
555 support staff. Overall, the findings of this study highlighted the extensive influence the menstrual
556 cycle may have on training and competition performance in elite female athletes, the individual
557 variability associated with this and discrepancy in openness of conversation with female compared to
558 male coaches and support staff.

559 Previous research has made us aware of data relating to the perceived impact of the
560 menstrual cycle on sport performance; Bruinvels et al.⁷ identified 51.1% of elite British female runners
561 and rowers felt their menstrual cycle had in some way impacted upon their training and performance,
562 Martin et al.²⁹ reported that 77% of elite athletes (n=430), not using hormonal contraception, had
563 negative side-effects during their menstrual cycle and Findlay et al¹⁴ highlighted experiences of the

564 menstrual cycle within elite rugby. However, there was a need to understand individual perceptions
565 and which aspects of the menstrual cycle impacted on training and competition in individual and
566 across multiple sports, as previous research has been predominately large-scale survey based
567 approaches with minimal qualitative elements which allow individual responses to be addressed. This
568 will help inform and influence best practice provided by coaches and practitioners¹³. Also notable is
569 the timing of when these symptoms were experienced, for some elite female athletes the week prior
570 to menses may have a greater impact in comparison to some who may experience heightened
571 symptoms once menses start. Consistent with our findings, ratings of symptoms have increased during
572 the premenstrual week and were maximal on the days immediately preceding and following the onset
573 of menstruation³⁰. It has been recognised the menstrual cycle causes recurrent, moderate-to-severe
574 affective, physical, and behavioural symptoms that develop during the luteal phase and disappear
575 within a few days of menstruation³⁰.

576 The current study has provided individual accounts of the perceived influence of the
577 menstrual cycle on training and performance. The ability of elite athletes to train due to adverse
578 symptoms was a prevalent feature; physical symptoms, including stomach cramps, lower back pain or
579 bloating were the predominant causes for training to be altered or missed. This is consistent with the
580 results described by Kishali et al.¹³, in which it was determined pain affects performance, further
581 supported by Findlay et al.¹⁴ and Kin, Yegu & Illi³¹ reporting 70.87% of athletes indicated painful
582 menstruation within their study. Psychological and affective symptoms also were reported in our
583 study, with feelings of lethargy, decreased motivation and distraction being the most recurrent
584 symptoms. These symptoms have been noted in both the general public and an elite athletic
585 population²⁹. These symptoms were recurrently experienced earlier than physical symptoms and
586 were not always recognized by the individual to be related to their menstrual cycle, until the physical
587 appearance of menses began when distraction also became a more prominent factor. It is possible
588 that individual's mood does consistently rise and fall over the course of the menstrual cycle—but that

589 the timing does not perfectly align across individuals³² providing a strength of the individual accounts
590 provided.

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

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

613 Having insight into individual variation in symptoms and perceived impact can increase the
614 understanding and inform best practice for coaches and practitioners working within elite sport. A

615 key aspect of the findings illustrates that one approach cannot be applied to all female athletes,
616 whether this is for symptoms and management, training, competition or increasing comfort and
617 openness of conversations. For example, only one athlete reported feeling increased muscle soreness
618 and taking longer to recover prior to menses, consistent with research by Hackney, Kallman & Aggon³³
619 evidencing female sex hormone changes due to the menstrual cycle can affect the physiological
620 responses during the recovery period. For this individual an increased focus on recovery may be
621 pertinent, ensuring training is adapted accordingly. Identifying and understanding experiences of the
622 individual elite female athlete regarding her menstrual cycle symptoms and responses is key for
623 coaches and practitioners to optimize performance through evidence informed practice.

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

632 Psychological determinants also commonly refer to changes in mood, but similarly to the
633 previously reported studies, most studies have presented averaged reports of mood across days that
634 fall into a defined phase. However, given that healthy individuals exhibit considerable variability in
635 cycle length, day of ovulation, and hormonal patterns³⁵, it is unlikely that these set phases capture the
636 same biological phenomenon across individuals. Instead it is important to identify individual
637 differences, as previously reported, to account for up to 16% of variance in mood symptoms³². Other
638 researchers have similarly found that individual patterns of change across the menstrual cycle are
639 more reliable in predicting significant discrepancies than attempts to fit people to an “average”
640 pattern of change³⁶. Within our study, unlike physical symptoms, not all females reported affective

641 and psychological symptoms. Some individuals reported changes in mood across different time
642 frames and severity was also variable. For instance, one female shared 'one month one thing will
643 happen, the next month something else will happen'. Therefore these symptoms are not only variable
644 between individuals but also within the same individual month to month. Comments including 'rather
645 watch TV and eat chocolate' rather than go training highlight mood and motivational changes
646 experienced in elite female athletes.

647 One consistently reported element was the distraction of leaking or blood showing through
648 clothes especially at competition, which was consistent across all sports, irrespective of competition
649 clothing which ranged from singlets, leotards, shorts and a white gi. This aligns with previous findings
650 in which the trauma of staining clothing or leaking through underwear was deemed the most
651 embarrassing event that could happen while menstruating^{4,14}. This is an element which should be
652 addressed within sport, providing athletes advice on menstrual products available and consideration
653 of clothes females are required to wear for competition.

654 Coping strategies utilised by the participants in the current study were predominately limited
655 to contraceptives or analgesic and anti-inflammatory medication to adapt and manage symptoms
656 impacting on training and performance otherwise an acceptance 'get on with it' approach was
657 observed. Most reported coping strategies were used to control the timing of menstruation, to be
658 able to control this in relation to competition performances, to prevent the onset of symptoms or the
659 inconvenience of bleeding and associated anxiety or distraction of leaking whilst performing. This was
660 consistent except for climbers in which controlling the menstrual cycle was more useful when in
661 locations without any toilet facilities and concerns of poor hygiene. Despite perception of limited
662 options 'I don't want to take pills, so there is not much I can do', other management strategies are
663 available. O'Brien et al¹⁰ highlighted non-drug-based treatments including education, relaxation
664 techniques, regular aerobic exercise and nutritional supplements. Within the present study, individual
665 athletes discussed some additional coping strategies such as use of heat for pain management, only
666 one athlete highlighted increasing rest pre-competition if this coincided with pre-menstrual symptoms

667 of decreased energy levels and increased lethargy to optimize performance. This may be related to a
668 heightened self-awareness. Elite female athlete education on coping strategies is recommended to
669 help reduce symptoms and impact on training and performance, this coincides with one athlete
670 sharing she had received “loads of workshops about diet and nutrition and like psychology and S&C
671 and stretching and meetings with physios but something that happens every month that you can’t
672 control, there’s nothing”. Currently, there is often a lack of support for many elite female athletes in
673 relation to their menstrual cycle compared to other areas of sport science which requires attention
674 due to the impact on health, wellbeing and performance.

675 The current findings provide some intriguing insights into individual- and group- factors that
676 relate to the openness of conversation about the menstrual cycle. Many athletes indicated an
677 openness to talk about the menstrual cycle to female support staff, however great variation in the
678 comfort athletes felt regarding talking to male coaches irrespective of duration of the relationship
679 between the coach and athlete was evident. This is consistent with recent findings in female team
680 sport, many athletes referred to staff gender when considering who they would feel comfortable
681 approaching in relation to menstrual cycle issues. It was acknowledged that previously, female staff
682 members had approached athletes and initiated discussions on menstrual cycle management prior to
683 a major event, and having a female doctor reduced the unease surrounding the subject¹⁴. Others
684 noted the unease at having menstrual cycle conversations with male support staff¹⁴. Also, female
685 athletes in the current study shared the opinion of an outdated culture not talking about the
686 menstrual cycle and questioning the reasoning for this. Perceptions were displayed that males ‘don’t
687 get it’ or are awkward talking about the menstrual cycle. This is supported by previous research
688 highlighting male coaches, compared to female coaches reported it was less important to ask athletes
689 about menstrual irregularity, being less comfortable communicating with female athletes about the
690 topic¹⁸. However, within this research ‘high knowledge coaches’ in relation to the menstrual cycle,
691 were more likely than ‘low knowledge coaches’ to discuss the female athlete triad irrespective of
692 gender¹⁸. Despite the current study not investigating coaching perceptions of openness of

693 conversation, as this was beyond the scope of the study, the current results in combination with
694 previous research highlight future support is required to change perceptions to improve conversations
695 held about the menstrual cycle in relation to sport performance. This could be essential in sport as
696 the IOC have released figures that at Rio Olympics 11% of accredited coaches were female yet in 2020
697 it is estimated that 48.8% of athletes will be female³⁷.

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

713 Improving both athlete and coach knowledge and providing education on the menstrual cycle,
714 correct terminology, constructing positive conversations and changing the perception of
715 awkwardness could significantly reduce the discomfort and outdated nature of not having
716 conversations relating to the menstrual cycle. Irrespective of coach knowledge, within the current
717 study, female athletes perceived comfort of conversation would improve if coaches received
718 education about the menstrual cycle. Improving coach knowledge of the menstrual cycle, how to have

719 positive conversations and insight into what individual female athletes may be experiencing was
720 raised as a factor within individual interviews to help improve the openness and comfort of having
721 conversations pertaining to the menstrual cycle. Teaching basic facts about the menstrual cycle is a
722 chance to correct misconceptions and misinformation learned, and show the power of culture and
723 social cognition on something as basic as a physiological process². This may contribute to improving
724 male coaches' ability to respond on a more individual basis to their athletes along the lines of gender¹⁹,
725 overcoming male coaches adjusting their practices to the detriment of their female athletes based
726 upon erroneous and unequal ideas of females as performers²⁰. Previous experiences and perceptions
727 of male awkwardness or lack of knowledge reduced the comfort of female athletes speaking openly
728 and sharing experiences with male coaches and practitioners; a determinant which needs to be
729 resolved. Research has stated educational materials for coaches should provide strategies for male
730 coaches to comfortably and sensitively address issues relating to menstrual health among their female
731 athletes. Indeed Kroshus et al.¹⁸ reported that coaches wanted to learn more about health issues
732 relevant to female athletes, including sports nutrition (88%), strength training and female athletes
733 (72%) and menstrual function.

734 **Applied Implications and future research direction**

735 The current findings detailing the perception and openness of conversation relating to the
736 menstrual cycle offer potentially important and previously unreported contributions to the literature.
737 In addition, our discussions with participants regarding information they would find useful to know in
738 relation to the menstrual cycle and sports performance can provide applied implications to provide
739 future direction and best practice for female athletes. As highlighted in the results, information
740 requested from elite athletes within our study can be grouped into five key areas; 1) contraceptives
741 including side effects, long term health impact and effect on training; 2) menstrual products; what
742 options are there and any products which are preferential for different sports; 3) how the menstrual
743 cycle can affect training and competition and management strategies for these; 4) coach education;
744 improving awareness and understanding and 5) Information for youth athletes and

745 opportunities/advice of who to talk to. Monitoring of the menstrual cycle may be advisable to elite
746 female athletes to increase self-awareness and better understand symptoms which are related to the
747 menstrual cycle which may lead to identifying positive management strategies. Continued education
748 and workshops for athletes, coaches and support staff is warranted to increase awareness of
749 symptoms and strategies and may positively contribute to optimizing training and performance of
750 female athletes, ensuring an ongoing process and not just a one-off talk⁴. This may be particularly
751 important for younger females who may not be managing their menstrual cycle effectively. Research
752 has stated females have identified the internet as an important educational source when it came to
753 menstruation and should be a consideration for further education for elite female athletes⁴. Alongside
754 being used to find out about the menstrual cycle and alternative menstrual products, the internet has
755 been used as a platform for monitoring symptoms and attempting to challenge traditional norms
756 about menstruation⁴. This requires further investigation and whether this is the best approach for
757 coaches and elite female athletes.

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

764 **Limitations**

765 Limitations of the study should be considered, for the first aim of the study, all athletes were
766 elite/senior level and did not capture perception and experiences of junior athletes which may vary in
767 symptoms, impact on training and performance and comfort of conversations. A large proportion of
768 the sample were climbers, which is not representative of more popular, traditional female sports (e.g.,
769 swimming, tennis, netball). However, despite this, the results were consistent across sports in most
770 regards excluding the outside environment of climbing and aligned with findings reported by Findlay

771 et al.¹⁴ in female rugby players. Only one interview was completed with each individual, additional
772 interviews may have increased comfort of conversations for some individuals and enhanced the depth
773 of discussion collected. In some instances it was the first time the female had openly discussed their
774 menstrual cycle, this may have influenced the quality of information collected alongside the different
775 times of the menstrual cycle when interviews were completed which may have provided different
776 responses due to recall error and symptoms being experienced at the time of interview. Relating to
777 the second aim of openness of conversation, there may be a bias in the sample in which athletes who
778 were interviewed participated because they were comfortable talking openly about the menstrual
779 cycle and may miss the perceptions of those that remain uncomfortable being involved in these
780 conversations. A questionnaire associated with discomfort and openness of conversation pertaining
781 to the menstrual cycle may better address this question. In conjunction, coaches' perceptions of
782 comfort of conversation were not collected within this study, which may influence communication
783 between the coach and athlete. However, as females perceived an awkwardness of male coaches in
784 conversation these perceptions should be considered in addition to the other factors identified
785 influencing conversation (age, previous conversations, experience and familiarity with the person). It
786 may be important for coaches to be aware of the perceptions and other influencing factors when
787 approaching the conversation about the menstrual cycle with elite female athletes. Future research
788 should be completed within this area to identify perceptions and experiences of coaches talking to
789 females athletes about the menstrual cycle when considering training and performance.

790 **Conclusion**

791 In summary, it is important to change any negative perceptions as the menstrual cycle is a
792 normal bodily function and physiological process which can impact on training and performance due
793 to the high prevalence of symptoms experienced. Elite female athletes' experiences varied greatly
794 between individuals, however many reported physical symptoms as well as mood disturbances and
795 reduced motivation to train. They sometimes sought to minimize training intensity and load. The
796 decision to actively control their menstrual cycle was often triggered by a desire to reduce the effect

797 on competition, particularly given that athletes were anxious about making their required weight in
798 some sports or distraction of leaking and blood showing through clothes. Athletes indicated an
799 openness to talk about the menstrual cycle to female support staff, however, there was great variation
800 in the comfort athletes felt regarding talking to male coaches. This was independent to the duration
801 of the athlete and coach relationship and in some instances linking to uncomfortable conversations
802 experienced at a younger age in school or sport. From an early age, females receive messages to hide
803 their periods and this is a perception that requires change in order to allow the positive aspects of
804 menstruation to be identified and openly talk to maximize sport performance. Considering how to
805 promote an environment of open discussion and establishing procedures for elite female athletes to
806 identify known points of contact are important to increase the opportunity to talk about the menstrual
807 cycle and impact on health, training and performance.

808 **Perspective**

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

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References

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- 822 1. Constantini NW, Dubnov G, & Lebrun CM. The menstrual cycle and sport performance. Clin
823 Sports Med 2005; 24: e51-82.

- 824 2. Chrisler JC. Teaching taboo topics: menstruation, menopause, and the psychology of women.
825 Psychology of Women Quarterly 2013; 37(1): 128-132.
- 826 3. Koff E, & Rierdan J. Preparing girls for menstruation: recommendations from adolescent girls.
827 Adolescence 1995; 30(120): 795-811.
- 828 4. Plan International UK. Break the barriers: girls' experiences of menstruation in the UK: 2018.
829 [https://plan-uk.org/file/plan-uk-break-the-barriers-report-032018pdf/download?token=F5-](https://plan-uk.org/file/plan-uk-break-the-barriers-report-032018pdf/download?token=F5-HYP3v)
830 [HYP3v](https://plan-uk.org/file/plan-uk-break-the-barriers-report-032018pdf/download?token=F5-HYP3v)
- 831 5. Hiller-Sturmhöfel S, & Barke A. The endocrine system: an overview. Alcohol Health & Research
832 World 1998; 22(3): 153-164.
- 833 6. Julian R, Hecksteden A, Fulagar HHK, & Meyer T. The effects of menstrual cycle phase on
834 physical performance in female soccer players. PLOS ONE 2017; 12(3): 1-13.
- 835 7. Bruinvels G, Burden RJ, McGregor AJ, Ackerman KE, Dooley M, Richards, T. et al. Sport,
836 exercise and the menstrual cycle: where is the research? Br J Sports Med 2016; 51(6): 487-
837 488.
- 838 8. Martin D, & Elliot-Sale K. A perspective on current research investigating the effects of
839 hormonal contraceptives on determinants of female athlete performance. Rev Bras Educ Fis
840 Esporte 2016; 30(4): 1087-1096.
- 841 9. Knowles OE, Aisbett B, Main LC, Drinkwater EJ, Orellana L, & Lamon S. Resistance training and
842 skeletal muscle protein metabolism in eumenorrheic females: implications for researchers
843 and practitioners. Sports Med 2019; published online doi.org/10.1007/s40279-019-01132-7
- 844 10. O'Brien S, Rapkin A, Dennerstein L, & Nevatte T. Diagnosis and management of premenstrual
845 disorders. Br J Med 2011; 342: 1297-1303.
- 846 11. Emmonds S, Heyward O, & Jones B. The challenge of applying and undertaking research in
847 female sport. Sports Medicine 2019; 5(51): 1-4.
- 848 12. Fleck S, & Kraemer W. Designing resistance training programs. Human Kinetics, Second Edition
849 1990; 193-197.
- 850 13. Kishali NP, Imamoglu O, Katkat D, & Akyol TAP. Effects of menstrual cycle on sports
851 performance. Intern J Neuroscience 2006; 116: 1549-1563.
- 852 14. Findlay RJ, Macrae HER, Whyte IA, Easton C, & Forrest LJ. How the menstrual cycle and
853 menstruation affect sporting performance: experiences and perceptions of elite female
854 rugby players. Br J Sports Medicine 2020; 0: 1-7.
- 855 15. Johnston-Robledo I, & Chrisler JC. The menstrual mark: menstruation as social stigma, Sex
856 Roles 2013; 68(1-2): 9-18.
- 857 16. Hoerster KD, Chrisler JC, & Gorman JA. Attitudes toward and experiences with menstruation
858 in the U.S. and India. Women & Health 2003; 38(3): 77-95.
- 859 17. Kissling EA. Capitalizing on the curse: The business of menstruation. Boulder: Rienner; 2006.
- 860 18. Kroshus E, Sherman RT, Thompson RA, Sossin K, & Austin B. Gender differences in high school
861 coaches' knowledge, attitudes, and communication about the female athlete triad. Eating
862 Disorders: The Journal of Treatment & Prevention 2014; 00: 1-16.
- 863 19. De Haan D, & Sotiriadou P. An analysis of the multi-level factors affecting the coaching of elite
864 women athletes. Managing Sport and Leisure 2019; 24(5): 307-320.
- 865 20. De Haan D, & Norman L. Mind the gap: the presence of capital and power in the female
866 athlete-male coach relationship within elite rowing. Sports Coaching Review 2020; 9(1): 95-
867 118.
- 868 21. Kristiansen E, Tomten SE, Hanstead DV, & Robert GC. Coaching communication issues with
869 elite female athletes: Two Norwegian case studies. Scan J Med Sci Sports 2012; 22: e156-167.
- 870 22. Sandelowski M. Focus on Research Methods. Whatever happened to qualitative description?
871 Research in Nursing & Health 2000; 23: 334-340.
- 872 23. Sandelowski M. What's in a name? Qualitative description revisited. Research in Nursing &
873 Health 2010; 33: 77-84.

- 874 24. Sparkes AC, & Smith B. Qualitative research in sport, exercise, and health: From process to
875 product. Abingdon, Oxon: Routledge; 2014.
- 876 25. Chalabaev A, Sarrazin P, Fontayne P, Boiché J, & Clément-Guillotin. The influence of sex
877 stereotypes and gender roles on participation and performance in sport and exercise: Review
878 and future directions. *Psychology of Sport & Exercise* 2013; 14(2): 136-144.
- 879 26. Patton MQ. Two decades of developments in qualitative inquiry: A personal, Experiential
880 Perspective. Thousand Oaks, CA: Sage; 2002, 261-285.
- 881 27. Miles MB, Huberman AM, & Saldana J. Qualitative Data Analysis: A Methods Sourcebook.
882 London: Sage; 2014.
- 883 28. Richardson L. Writing a Method of Inquiry. In N. K. Denzin and Y. S. Lincoln (Eds.), *Handbook*
884 *of qualitative research*. Thousand Oaks, CA: Sage; 1994, 2nd ed. 293–248.
- 885 29. Martin D, Sale C, Cooper SB, et al. Period Prevalence and Perceived Side Effects of Hormonal
886 Contraceptive Use and the Menstrual Cycle in Elite Athletes. *Int J Sports Physiol Perform*
887 2018;13:926-932.
- 888 30. Taylor JW. The timing of menstruation-related symptoms assessed by a daily symptom rating
889 scale. *Acta Psychiatrica Scandinavica* 1979; 60(1): 87-105.
- 890 31. Kin A, Yegu I, Illi M. Menstruation in women with and without athletes comparisons of
891 features. *Gazi J of Physical Ed & Sport Sci* 2000; congress 1: 159-164.
- 892 32. Lorenz TK, Gesselman AN & Vitzthum VJ. Variance in mood symptoms across menstrual cycles:
893 implications for premenstrual dysphoric disorder. *Womens Reprod Health (Phila)* 2017; 4(2):
894 77-88.
- 895 33. Hackney AC, Kallman AI, & Ağgön E. Female sex hormones and the recovery from exercise:
896 Menstrual cycle phase affects responses. *Biomedical Human Kinetics* 2019; 11: 87–89
- 897 34. Gillet N, Berjot S, Vallerand, RJ, Amoura S, & Rosnet E. Examining the motivation-performance
898 relationship in competitive sport: A cluster-analytic approach. *Int J Sports Psychol* 2012; 43:
899 79-102.
- 900 35. Fehring RJ, Schneider M, & Raviele K. Variability in the phases of the menstrual cycle. *Journal*
901 *of Obstetric, Gynecologic, and Neonatal Nursing* 2006; 35: 376–384.
- 902 36. Kiesner J, Mendle J, Eisenlohr-Moul TA, & Pastore M. Cyclical symptom change across the
903 menstrual cycle: Attributional, affective, and physical symptoms. *Clinical Psychological*
904 *Science* 2016; 4: 882–894.
- 905 37. International Olympic Committee. Women at the Olympic Games Statistics 2019.
906 <https://www.olympic.org/women-in-sport/background/statistics>
- 907 38. Jowett S, & Cockerill I. *Incompatibility in the coach-athlete relationship*. In I. Cockerill Solutions
908 in Sport Psychology. London: Thompson Learning 2002; 16-29.
- 909 39. Jowett S. Coaching effectiveness: the coach-athlete relationship. *Current Opinion in*
910 *Psychology* 2017; 16: 154-158.
- 911 40. Jowett S. The coach-athlete partnership. *The psychologist* 2005; 18(7): 412-415.