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2 **Knowledge, attitudes, and behaviours towards the menstrual cycle and**  
3 **menstruation among elite African women football players, coaches, medical**  
4 **personnel, and referees.**

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## ABSTRACT

36 Despite cross-cultural differences in knowledge and attitudes towards menstruation, most  
37 studies on menstruation in women's sport have been conducted in high income countries,  
38 like in Europe and none have been conducted in Africa. The aim of this study was to  
39 explore the knowledge, attitudes, and behaviours of African elite women football players,  
40 and their support personnel, towards the menstrual cycle and menstruation.

41 An anonymous questionnaire was distributed to participants (n=564) at two African  
42 women football tournaments. Ultimately, 238 women football players, 44 coaches, 18  
43 health personnel and 17 referees completed it. From 317 questionnaires, 17%, 27%,  
44 56%, and 0% of players, coaches, health personnel and referees, respectively, knew at  
45 least one menstrual cycle hormone; 91%, 95%, and 100% of players, coaches, and  
46 referees, respectively, did not know at least one menstrual cycle phase. Over 70% of  
47 health personnel believed that menstruation negatively affects women's performance in  
48 sports compared to 36% of players; 18%, 28%, and 18% of players, health personnel and  
49 referees, respectively, believed that it should be changed by contraceptives; and 54%,  
50 61%, 62%, and 40% of players, coaches, health personnel and referees, respectively  
51 were confident providing advice about the menstrual cycle to teammates.

52 Minimal knowledge of the menstrual cycle has implications on the development of  
53 menstrual cycle considerate training programs and educational materials in African  
54 women's football. Further, the relatively low perceived effect of the menstrual cycle on  
55 sporting performance may be attributable to differences in community level religio-cultural  
56 and social contexts, which influence experiences and behavioural expectations.

57 **KEYWORDS:** Africa, athletes, female, menstruation, period, soccer

## INTRODUCTION

59 The menstrual cycle is a normal physiological process experienced by females from an  
60 average age of 13 years (Pasquet et al., 1999; Garenne, 2020), until about 51 years,  
61 which is the average age of menopause (Burger et al., 2007). The menstrual cycle carries  
62 biological, socio-cultural, and psychological implications, and religious connotations, of  
63 which many are perceived to be negative (Tan, Haththotuwa & Fraser, 2017). In women  
64 athletes, the relationship between the menstrual cycle, hormonal fluctuations, wellbeing,  
65 and athletic performance is complex (McNulty et al., 2020). Though the primary function  
66 of the major hormones of the menstrual cycle is to support reproduction, the menstrual  
67 cycle can also be leveraged as marker of overall health to monitor conditions that may  
68 affect the menstrual cycle frequency, length or volume, or present as abnormal menstrual  
69 cycles, such as relative energy deficiency in sport (RED-S) (Mountjoy et al., 2018).  
70 Further, the hormones of the menstrual cycle also influence other physiological functions,  
71 such as mood, metabolism, soft tissue integrity, and pulmonary function (Davydov et al.,  
72 2005; Oosthuysen & Bosch, 2010; Chidi-Ogbolu & Baar, 2019; Batham & Gupta, 2019).  
73 Additionally, studies have shown that negative menstrual cycle symptoms such as  
74 mood/anxiety changes, abdominal cramping, and heavy bleeding, are common in women  
75 and may compromise athletic performance in exercising women (Bruinvels et al., 2016;  
76 Bruinvels et al., 2020; Findlay et al., 2020).

77 Understanding the relationship between the menstrual cycle, performance, injury risk,  
78 training, and recovery may improve the design of training schedules and help optimise  
79 performance in women athletes. This requires that women athletes and their support  
80 personnel are knowledgeable of the menstrual cycle. In addition, positive attitudes

81 towards the menstrual cycle are likely to yield greater benefits in optimising performance.  
82 While a handful of studies have explored menstrual cycle symptomatology (Bruinvels et  
83 al., 2016; Bruinvels et al., 2020) and women athletes' lived experiences (Read et al.,  
84 2021; Findlay et al., 2020; Caballero-Guzman & Lafaurie-Villamil, 2020), data on women  
85 athletes and their support personnel's knowledge, attitudes and behaviours towards the  
86 menstrual cycle are relatively scarce. Scarcer still are data on women match officials  
87 (referees), who are an integral part of sport and are athletes in their own right. Referees  
88 must train for and sustain the physiological demands of the games as they officiate  
89 (Krustup & Bangsbo, 2001) but are infrequently included in football medicine research.

90 Despite observed gender and cross-cultural differences in attitudes and behaviours  
91 towards the menstrual cycle and menses, most studies on the menstrual cycle in sport  
92 have thus far been conducted on women participants in high income and relatively  
93 egalitarian countries, such as Australia and those in Europe (Findlay et al., 2020; Larsen  
94 et al., 2020; Clarke, Govus & Donaldson, 2021; Brown and Knight, 2022). It is, therefore,  
95 important that the knowledge, attitudes, and behaviours of athletes and support personnel  
96 from low- to middle-income, largely patriarchal societies, such as in sub-Saharan Africa  
97 be investigated as well. This is important to ensure contextual relevance and hence  
98 greater applicability to stakeholders (such as players, athlete support personnel,  
99 administrators and match officials) in African women's football. Therefore, the aim of this  
100 study was to explore the knowledge, attitudes, and behaviours of African elite women  
101 football players, and their support personnel, towards the menstrual cycle and  
102 menstruation.

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## METHODOLOGY

### 105 *Study design and participants*

106 This is a cross-sectional study, which was conducted during two African women football  
107 tournaments: (1) the 2021 Council of Southern African Football Associations (COSAFA)  
108 Women's Championship in Gqeberha, South Africa in September 2021, and (2) the 2021  
109 TOTAL Energies Confederation of African Football Women's Champions League  
110 (CAFWCL) finals in Cairo, Egypt in November 2021. The COSAFA Women's  
111 Championship is an association football tournament for ten national teams from Southern  
112 Africa (Angola, Botswana, Comoros Islands, Eswatini, Lesotho, Malawi, South Africa,  
113 Zambia, and Zimbabwe) and the CAF Women's Champions league is a continental club  
114 competition of eight (8) women's football clubs that are champions in their respective  
115 domestic club football leagues in each of CAF's six (6) regions.

116 All players and player support personnel (i.e., coaches, health personnel, referees) who  
117 participated in the two tournaments were eligible to participate in the study. In total, the  
118 two tournaments included 424 players, 60 coaches, 40 health personnel, and 40 referees  
119 (n=564). Participation in the study required participants to be literate in basic English,  
120 French, Portuguese, Spanish, or Arabic in order to complete a questionnaire to quantify  
121 their knowledge, attitudes, and behaviours towards the menstrual cycle and menstruation.  
122 Participants also provided demographic information (i.e., age, gender, education level,  
123 country of residence and competition level).

124 Participation in the study was voluntary and it was conducted according to the  
125 principles of the Helsinki Declaration. Participants were only included in the study

126 after the investigator provided substantial verbal and written explanation of the study,  
127 and after participants signed an informed consent form. Though ethical clearance was  
128 granted for football players >15 years old, for the purposes of this study, only women  
129 football players aged  $\geq 18$  years and football stakeholders (e.g., coaches, health  
130 personnel, referees, administrator, media) participating at the CAFWCL finals and the  
131 COSAFA Women Championships in 2021 were eligible to participate. Ethical clearance  
132 was granted by the institutional review board of Midlands State University, Gweru,  
133 (Zimbabwe).

#### 134 *Questionnaire*

135 The questionnaire (Supplementary Table 1), was adapted from Larsen et al. (2020),  
136 Brown et al. (Brown, Knight & Forrest 2020) and the Menstrual Attitudes Questionnaire  
137 (Brooks-Gunn & Ruble, 1986). The participants were requested to complete the  
138 questionnaire at a time and day that was convenient for them during their team's time in  
139 either tournament. This approach for recruitment and testing was adopted to minimise  
140 disrupting their training, competitive, and recovery schedules. Participants completed the  
141 knowledge section of the questionnaires in the researchers' presence to prevent them  
142 researching the answers to the questions (Larsen et al., 2020).

#### 143 *Statistical analyses*

144 Data were processed using IBM SPSS Statistics for Windows, v 28.0. (IBM Corp,  
145 Armonk, NY, USA), and standard descriptive statistical analyses were conducted. For  
146 demographic data, normally distributed data were presented as mean ( $\pm$  standard  
147 deviation). Where data were not normally distributed, they were presented as median  
148 [interquartile range]. The reported symptoms were presented as absolute numbers,



149 proportions/percentages, n(%). Data were excluded from analysis when there were too  
150 few responses ( $n \leq 5$ ) per group to analyse. We performed post hoc analyses with  
151 univariate comparisons of demographic variables with the number of correct answers in  
152 the knowledge section using Spearman's correlation, Mann-Whitney U-test, and Kruskal-  
153 Wallis H-test.

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## RESULTS

157 A total of 369 responses were obtained (65.4% response rate). Fifty-two (52) responses  
158 were excluded for having inadequate information (n=18), participants being less than 18  
159 years old (n=11), belonging to football stakeholder positions that had less than five (5)  
160 members each (e.g. administrator, player agent, media) (n=19) and male football players  
161 (n=4). Therefore, 317 (56.2%) responses were available for analysis. The majority  
162 (n=238; 75%) of the respondents were women football players, 44 (13.8%) were coaches,  
163 18 (5.7%) were health care personnel and 17 (5.4%) were referees. A full list of participant  
164 demographic information can be found in **Table 1**.

### 165 *Knowledge of the menstrual cycle and menstruation*

166 Only 54 (23%) players, 6 (14%) coaches, 9 (50%) medical personnel, and 4 (24%)  
167 referees knew the average duration of a menstrual cycle; only 40 (17%) players, 12 (27%)  
168 coaches, 10 (56%) of health personnel and none (0%) of the referees could name at least  
169 one menstrual cycle hormone; and 216 (91%), 42 (95%), and 17 (100%) players,  
170 coaches, and referees, respectively, could not name at least one menstrual cycle phase.  
171 The majority (n=216, 68%) of participants did not know the effect of insufficient energy  
172 intake on the menstrual cycle and only 79 (33%), 16 (36%), 12 (67%), and 1 (6%) players,  
173 coaches, medical personnel, and referees, respectively, knew the definition of  
174 amenorrhoea (**Table 2**). The median number of correct answers were 2 out of 7 (IQR 0–  
175 2, range 0–7). There was no statistically significant correlation between age and number  
176 of correct answers ( $r=0.015$ ,  $p=0.807$ ). There was no statistically significant difference in  
177 the distribution of the number of correct answers between females and males ( $U=4035$ ,

178 p=0.258). There was a statistically significant difference in the number of correct answers  
179 between the different levels of education ( $\chi^2 = 21.7$ ,  $p < 0.001$ ), with mean ranks scores of  
180 240 for Doctorate, 186 for Bachelors, 179 for primary, 169 for Masters, 142 for secondary,  
181 and 129 for diploma level. There was also a statistically significant difference in the  
182 number of correct answers between the different groups of participants ( $\chi^2 = 18.8$ ,  
183  $p < 0.001$ ) with mean rank scores of 228 for health personnel, 164 for players, 141 for  
184 coaches, and 105 for referees.

### 185 *Perspectives and attitudes towards the menstrual cycle and menstruation*

186 A similar proportion of players believed that sports performance is not negatively affected  
187 by menstruation (40.8%,  $n=97$ ) as those who believed it was (37.4%,  $n=89$ ). In contrast,  
188 13 (72.9%) health personnel believed that menstruation can negatively affect women's  
189 performance in sports. Nearly 70% of players ( $n=159$ ) believed that women are more tired  
190 than usual when they are menstruating; however, 154 (64.7%) believed women do not  
191 allow menstruation to interfere with their usual activities. The majority of players ( $n=188$ ,  
192 79%) considered menstruation a recurring affirmation of womanhood and 165 (69%)  
193 believed that it provides a way for women to keep in touch with their bodies. Additionally,  
194 98 (41.2%) of the players believed that a woman who attributes her irritability to her  
195 approaching menstrual period is psychologically disturbed, a view shared by nearly 40%  
196 ( $n=7$ ) of health personnel and 8 (47%) referees. Similarly, nearly 30% ( $n=72$ ) of players  
197 consider premenstrual tension/irritability to be 'all in a woman's head', while 39.2% ( $n=87$ )  
198 disagreed (**Table 3 and Supplementary Tables 2 and 3**).

### 199 *Behaviours towards the menstrual cycle and menstruation*

200 The majority (n=140; 59%) of players, coaches (n=28; 64%), referees (n=9; 53%) and  
201 nearly half of the health personnel (n=8; 44%) had not had training in female physiology  
202 and it was not provided for the majority of players (n=130; 55%), coaches (n=27; 61%),  
203 health personnel (n=11; 61%), or referees (n=11; 65%). Players' main source of  
204 information on the menstrual cycle were their family (33%, n=78), while the team doctor  
205 was an uncommon source of information (0.8%, n=2). Nearly half (53%, n=125) of the  
206 players reported that their teams provided menstrual products. Most of the coaches  
207 (n=27, 68%), health personnel (n=13, 72%), referees (n=10, 59%) and just less than half  
208 of the players (n=117, 49%) were confident or extremely confident with their knowledge  
209 of the menstrual cycle, while 183 (77%) of players, 37 (74%) coaches, 17 (94%) health  
210 personnel, 14 (82%) referees thought it would be beneficial or extremely beneficial to  
211 receive training on the menstrual cycle and sporting performance (**Table 4**).

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## DISCUSSION

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Overall, the findings of this study highlighted a lack of knowledge and understanding of the menstrual cycle and hence sub-optimal behaviours of elite African women football players, their support personnel, and referees. The results identified the need for more education and support to be provided to players, coaches, referees and, in some instances, to health personnel as well.

### *Knowledge of the menstrual cycle and menstruation*

Knowledge of the menstrual cycle was low in this cohort, especially with regards to the duration of the menstrual cycle, names of hormones and menstrual cycle phases. For the most part, participants likely confused the menstrual *cycle* with the menstrual *period*, as their responses to the duration of the complete cycle tended to be closer to the duration of menses than of the menstrual cycle (data not shown). This low knowledge of the menstrual cycle mirrors data from other sporting cohorts of Australian, British, and Indian women athletes (Larsen et al., 2020; Brown, Knight & Forrest, 2020; Majumder et al., 2022) as well as Australian football coaches (Clarke, Govus & Donaldson, 2021). Notably, Larsen et al. (2020) found that only 16% of Australian elite athletes knew the two main hormones that fluctuate throughout the menstrual cycle. Clarke et al. (2021) observed that knowledge of the menstrual cycle and athletic performance was low in Australian football coaches; while Brown et al. (2020) reported limited awareness of the menstrual cycle and performance in a women's cohort of mixed sports codes. While most of the respondents in the present study likely have experiential knowledge of the menstrual

236 cycle as menstruating women and girls, the basic technical knowledge of the menstrual  
237 cycle is low. That there were no statistical differences in knowledge scores between male  
238 and female participants in this cohort underscores this observation. In general, low  
239 knowledge of the subject is associated with suboptimal communication about the  
240 menstrual cycle (e.g., social exclusion or advice to avoid swimming or wet hair as it is  
241 believed to be physically dangerous during menses) (Barrington et al., 2021), poor  
242 menstrual hygiene management practices, and perpetuates the taboos associated with  
243 menstruation (Nnennaya et al., 2021). It is therefore important that stakeholders in African  
244 women's football increase their knowledge of, for example, the difference between the  
245 duration of the menstrual period and menstrual cycle, the phases thereof, and the  
246 hormones involved. In addition to the personal benefits of increased body literacy among  
247 women and girls, accurate knowledge of basic female physiology in women athletes and  
248 those who support them is vital for the successful promotion and adoption of menstrual  
249 cycle consideration in training and recovery, nutrition, and injury risk assessment in  
250 women's football (McHaffie et al., 2022; Bruinvels et al., 2020; Carmichael et al., 2021;  
251 Meignie et al., 2021).

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### 253 *Perspectives and attitudes towards the menstrual cycle and menstruation*

254 Players were equivocal about whether menstruation negatively affects sporting  
255 performance: the proportion of players who believed that sports performance is negatively  
256 affected by menstruation was similar to those who believed that it was not. In contrast,  
257 more than 70% of health personnel believed that menstruation can negatively affect  
258 women's performance in sports (Supplementary Tables 2 and 3). The present results

259 contrast previous studies, which have shown that up to 100% of women athletes perceive  
260 a negative effect of the menstrual cycle on athletic performance (Meignie et al., 2021;  
261 McNamara, Harris & Minahan, 2022; Read et al., 2021; Righi & Barroso, 2022; Findlay et  
262 al., 2020). However, in a study of women football players from Southern Africa, only 24%  
263 reported a perceived effect of the menstrual cycle on their performance (Mkumbuzi et al.,  
264 2021). This wide discrepancy in perceived effect in women athletes from high income  
265 countries compared to those from low- and middle-income countries (LMICs) such as in  
266 Africa may be attributable to differences in the socio-cultural contexts (McMahon et al.,  
267 2011; Phillips-Howard et al., 2016). Across cultures in LMICs, menstruation is  
268 stigmatised, and shrouded in silence, shaping internalised attitudes that manifest in  
269 externally enforced explicit socio-cultural or religious expectations to keep menstrual  
270 status and its effects hidden (Hennegan et al., 2019; Barrington et al., 2021). Hence, it is  
271 not discussed openly, making it difficult to seek support as menstrual discomforts are  
272 considered a 'normal' part of life that should not impact on participation or work quality  
273 (Barrington et al., 2021). Additionally, while there is increased research and in depth  
274 discussion of menstrual experiences in high income countries (HICs), the same cannot  
275 be said for low- and middle-income countries (LMICs) (Barrington et al., 2021); therefore,  
276 increased media and public exposure attention and discussion of the issue in HICs may  
277 explain why women athletes are perceiving greater impact compared to their LMIC  
278 counterparts. Additionally, the discrepancy between health professionals' and players'  
279 perceived effects in our cohort may be due to the latter's knowledge and understanding  
280 of the physiology of the menstrual cycle, which was (unsurprisingly) significantly higher  
281 than that of players and coaches in this cohort. Broadly though, in team environments

282 that acknowledge that sports performance may be negatively affected by the menstrual  
283 cycle, it may be easier to make the relevant adjustments for players whose menstrual  
284 cycles negatively affect their performance, while minimising them in those that do not  
285 (McHaffie et al., 2022).

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287 The majority of players considered menstruation a recurring affirmation of womanhood  
288 and a way for women to keep in touch with their bodies. However, over 70% of players  
289 also believed that menstruation is something women have to put up with and that it is only  
290 useful for women to know whether or not they are pregnant (56%). The former perception  
291 (that menstruation is something women have to put up with) may indicate a lack of  
292 knowledge of the normal menstrual cycle, internalised social expectations to conceal the  
293 physical symptoms, and a subsequent inability to identify and seek help for menstrual  
294 cycle dysfunctions , hence putting up with abnormal menstrual symptoms (Barrington  
295 et al., 2021). The latter (periods are only useful to know whether or not they are pregnant)  
296 corroborates the lack of knowledge of the menstrual cycle hormones and their non-  
297 reproductive functions in maintaining bone, muscle, cardiovascular, and cognitive health  
298 (Chidi-Ogbolu & Baar, 2019; Talaulikar, 2022; El Khoudary et al.,2020). Additionally,  
299 about 40% of players in the current study contend that it would be wise to avoid certain  
300 activities during menstruation. This may be a reflection of prevailing sociocultural norms  
301 that view the menses as symbolically unclean, which in turn may limit participation of  
302 women and girls in school, work, and sport (McMahon et al., 2011; Phillips-Howard et al.,  
303 2016).

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305 Though negative attitudes towards menstruation are prevalent in many LMICs (McMahon  
306 et al., 2011; Phillips-Howard et al., 2016; Barrington et al., 2021; Hennegan et al., 2019),  
307 from the present results, individuals in the African women's football ecosystem do not  
308 generally hold negative attitudes towards menses. This is encouraging and presents a  
309 good opportunity to encourage players and their support personnel to have candid  
310 discussions about the menstrual cycle's nature and regularity. Such information can be  
311 used as a way of monitoring conditions that may affect the menstrual cycle, or present as  
312 abnormal menstrual cycles, such as relative energy deficiency in sport (RED-S) (Mountjoy  
313 et al., 2018). It also provides a platform for the normalisation of the menstrual cycle in the  
314 discourse in African women's football, which may, in turn, allow the development of  
315 menstrual cycle and menstruation considerate training programs (Heyward et al., 2022;  
316 Findlay et al., 2020; McHaffie et al., 2022). Further, sport such as football could be used  
317 as a vehicle to educate and inform women and girls in general on the menstrual cycle  
318 and break the taboos around it. It is, therefore, incumbent upon support staff to create a  
319 team environment that promotes positive team norms towards the menstrual cycle and  
320 allows players to discuss it (Heyward et al., 2022; Findlay et al., 2020; McHaffie et al.,  
321 2022). This is even more important as there are not many women coaching and support  
322 staff for women football players and women athletes in general (Heather et al., 2021;  
323 Geertsema et al., 2019), which underscores the need to include men and boys in  
324 menstrual cycle education and training.

325

326 A minority of players (18%), health personnel (28%), and referees (18%) were in favour  
327 of altering the menstrual cycle using drugs such as hormonal contraceptives. This is much

328 lower than the prevalence of hormonal contraceptive use in HIC cohorts of women  
329 athletes (Findlay et al., 2020; Nolan, Elliot-Sale & Egan, 2022; Heyward et al., 2022), but  
330 is similar to previous work on African women football players (Mkumbuzi et al., 2021).  
331 This difference may be informed by community level socio-cultural or religious norms in  
332 Africa, which may prevent young (unmarried) females from using contraceptives.  
333 Premarital sexual activity is not well accepted in Africa as sexual activity is only  
334 considered acceptable within marriage (Agyemang et al., 2019). Hence, the use of  
335 contraceptives by unmarried women and girls may be construed to mean users are  
336 promiscuous and 'careless' (Appiah et al., 2020; Agyemang et al., 2019). Indeed, fear of  
337 being labelled as promiscuous by peers has been cited as a reason for not using  
338 contraceptives in some cohorts of young African females (Appiah et al., 2020). This  
339 reticence to alter the menstrual cycle pharmacologically may also reflect the general fear  
340 of adverse side effects from long term use of hormonal contraceptives (Nolan et al., 2022;  
341 Clarke et al., 2021).

#### 342 *Behaviours towards the menstrual cycle and menstruation*

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344 The majority of participants in this cohort had not had training in female physiology. This  
345 finding may explain the low level of knowledge of the menstrual cycle seen in our study,  
346 which may in turn be due to a lack of training capacity in most teams, or because  
347 menstruation is still stigmatised and is generally considered socially taboo (Heather et al.,  
348 2021). Thus, many women athletes tend to be too embarrassed or too ashamed to speak  
349 about their periods within their teams (Brown et al., 2020; Appiah et al., 2020). Despite  
350 the observed low knowledge and lack of training, nearly half of the players, and most of

351 the coaches health personnel and referees were comfortable/confident or extremely  
352 comfortable/confident with their knowledge of the menstrual cycle and providing advice  
353 about the menstrual cycle in their team. As most of the respondents in this study were  
354 women, this confidence likely stems from the 'operational' knowledge of the menstrual  
355 cycle and menstruation from their personal experiences. This confidence can be  
356 capitalised on by providing resources on the subject to women's football teams and  
357 equipping these stakeholders and the general public with accurate information. Indeed,  
358 an overwhelming majority of participants believed that it would be of some benefit to  
359 receive training on the menstrual cycle and sporting performance. Similar to Clarke et  
360 al.'s study, coaches expressed interest in understanding the psychological effects of the  
361 menstrual cycle on female athletes, the medical and training considerations, as well as  
362 how to communicate with their athletes about the menstrual cycle (Clarke et al., 2021).  
363 This openness to receiving training on the menstrual cycle implies that such education  
364 may be well received if conducted and may help break the taboos around menstruation  
365 in women's sport.

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### 367 *Limitations*

368 These results are not without limitations. Firstly, while these data are from participants  
369 from various regions of the African continent, which provides the views from various  
370 socio-cultural backgrounds, they were collected at two, top tier tournaments, at a single  
371 time point. Hence, these results should be generalised to other populations of African  
372 women's football players, coaches, medical personnel, and referees with caution.  
373 Secondly, as this cohort was recruited at a women's football tournament, the sample size

374 was predominantly of women football players. However, this over representation allows  
375 us to gain an in-depth understanding of the women players' perspectives, which may  
376 inform the development of resources that specifically target women players. Lastly, there  
377 is a significant proportion of missing responses (up to 16% in some instances) from the  
378 questionnaires. It is likely that due to a perceived lack of knowledge, participants chose  
379 to not answer rather than provide incorrect answers, or it may indicate discomfort in  
380 discussing this subject.

### 381 **Conclusion**

382 The findings of this study highlight a lack of knowledge and understanding of the  
383 menstrual cycle among African women football players, coaches, health personnel, and  
384 referees combined with sub-optimal attitudes and behaviours. The results identified the  
385 need for more education and support to be provided to players, coaches, match officials,  
386 and in some instances to health personnel as well. The positive attributes observed in this  
387 cohort, such as confidence in providing advice and openness to receiving training on the  
388 menstrual cycle, can be capitalised on to provide accurate information and help promote  
389 menstrual cycle and menstruation considerations in African women's football culture.

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552

553 **Table 1:** Demographic characteristics of study participants

	<b>Players (n=238)</b>	<b>Coaches (n=44)</b>	<b>Health personnel (n=18)</b>	<b>Referees (n=17)</b>
<b>Age at recruitment (years)</b>	23 (21–28)	38 (36–44)	36 (29–44)	33 (29–37)
Missing responses	39 (16)	5 (11)	4 (22)	0 (0)
<b>Gender</b>				
Woman	228 (96)	24 (55)	8 (44)	17 (100)
Man	0 (0)	19 (43)	10 (56)	0 (0)
Other	2 (1)	0 (0)	0 (0)	0 (0)
Missing responses	8 (3)	1 (2)	0 (0)	0 (0)
<b>Country of residence</b>				
Namibia	25 (11)	0 (0)	0 (0)	1 (6)
Kenya	21 (9)	16 (36)	2 (11)	0 (0)
Mozambique	21 (9)	8 (18)	2 (11)	0 (0)
South Africa	20 (8)	1 (2)	0 (0)	0 (0)
Egypt	19 (8)	4 (9)	3 (17)	3 (17)
Ghana	18 (8)	1 (2)	0 (0)	0 (0)
Morocco	17 (7)	2 (5)	3 (17)	0 (0)
Malawi	14 (6)	1 (2)	1 (6)	3 (17)
Uganda	14 (6)	0 (0)	0 (0)	1 (6)
Zimbabwe	13 (6)	5 (11)	2 (11)	2 (12)
Angola	11 (5)	2 (5)	2 (11)	0 (0)
Nigeria	10 (4)	2 (5)	1 (6)	0 (0)
Other countries*	28 (11.8)	1 (2)	2 (12)	7 (41)
Missing responses	7 (3)	1 (2)	0 (0)	0 (0)
<b>Highest educational qualification attained</b>				
Doctorate	0 (0)	1 (2)	4 (22)	0 (0)
Masters	2 (1)	6 (14)	4 (22)	1 (6)
Bachelors	32 (13)	9 (21)	6 (33)	4 (24)
Diploma	38 (16)	8 (18)	4 (22)	5 (29)
Secondary school	147 (62)	16 (36)	0 (0)	7 (41)
Primary school	2 (1)	0 (0)	0 (0)	0 (0)
Missing responses	17 (7)	4 (9)	0 (0)	0 (0)
<b>Level of football participation</b>				
Amateur	55 (23)	8 (18)	2 (11)	1 (6)
Semi-professional	39 (16)	7 (16)	2 (11)	2 (12)
Professional	131 (55)	27 (61)	13 (72)	12 (71)
Missing responses	13 (6)	2 (5)	1 (6)	2 (12)
<b>Duration of football participation (years)</b>	12 (9–15)	20 (13–25)	14 (6–19)	13 (9–19)
Missing responses	35 (15)	5 (11)	4 (22)	0 (0)

554 Data are presented as median (Q1–Q3) or n (%)

555 \*Countries with less than 10 players were grouped as other and included Equatorial Guinea, Mali, USA, Cameroon, Burkina Faso,  
556 Cote d'Ivoire, Democratic Republic of Congo, Brazil, Italy, Zambia, Eswatini, Lesotho, Botswana, Tanzania

557 **Table 2:** Knowledge of the menstrual cycle and menstruation among African women  
 558 football players, coaches, health personnel, and match officials (n=317). Responses  
 559 considered correct are provided in brackets following each question.

Questions/Responses	Players (n=238)	Coaches (n=44)	Health personnel (n=18)	Referees (n=17)
<b>At what age do girls have menarche? (years)*</b>	13 [12–15]	13 [12–14]	12 [11.5–13]	13 [12–15]
<b>What is the average duration of the menstrual cycle?</b>				
- Correct ( <i>Any value from 21 to 45 days</i> )	54 (23)	6 (14)	9 (50)	4 (24)
- Incorrect	166 (70)	27 (61)	8 (44)	12 (71)
- I don't know	2 (1)	3 (7)	0 (0)	0 (0)
- Missing response	16 (7)	8 (18)	1 (6)	1 (6)
<b>What is the average duration of the menstrual period?</b>				
- Correct ( <i>Any value from 2 to 7 days</i> )	121 (51)	10 (23)	8 (44)	5 (29)
- Incorrect	63 (27)	18 (41)	7 (39)	5 (29)
- I don't know	12 (5)	2 (5)	0 (0)	4 (24)
- Missing response	42 (18)	14 (32)	3 (17)	3 (18)
<b>What are the three main ovarian hormones?</b>				
- Correct (3 hormones- <i>progesterone, oestrogen, LH/FSH</i> )	0 (0)	0 (0)	3 (17)	0 (0)
- Correct (2 hormones)	6 (3)	1 (2)	7 (39)	0 (0)
- Correct (1 hormone)	34 (14)	11 (25)	0 (0)	0 (0)
- Incorrect	32 (13)	6 (14)	0 (0)	0 (0)
- I don't know	50 (21)	5 (11)	3 (17)	8 (47)
- Missing response	116 (49)	21 (48)	5 (28)	9 (53)
<b>What are the three distinct phases of the menstrual cycle?</b>				
- Correct (3 phases- <i>menstrual, follicular, luteal</i> )	5 (2)	0 (0)	1 (6)	0 (0)
- Correct (2 phases)	4 (2)	0 (0)	4 (22)	0 (0)
- Correct (1 phase)	13 (4)	2 (5)	2 (11)	0 (0)
- Incorrect	47 (20)	15 (34)	0 (0)	0 (0)
- I don't know	47 (20)	4 (9)	3 (17)	8 (47)
- Missing response	122 (51)	23 (52)	8 (44)	9 (53)
<b>What happens to the natural ovarian hormones produced by the body when one takes hormonal contraceptives (e.g. the pill, injection or rod)?</b>				
- Correct ( <i>they decrease</i> )	60 (25)	10 (23)	9 (50)	4 (24)
- Incorrect	32 (13)	5 (11)	4 (22)	2 (12)
- I don't know	115 (48)	20 (45)	2 (11)	9 (53)
- Missing response	31 (13)	9 (21)	3 (17)	2 (12)
<b>What is the effect of insufficient food intake on the menstrual cycle?</b>				
- Correct ( <i>menstruation may stop</i> )	32 (13)	5 (11)	7 (39)	0 (0)
- Incorrect	163 (69)	29 (66)	9 (50)	15 (88)
- I don't know	0 (0)	0 (0)	0 (0)	0 (0)
- Missing response	43 (18)	10 (23)	2 (11)	2 (12)
<b>What is amenorrhoea?</b>				
- Correct ( <i>A condition of the absence of menstruation</i> )	79 (33)	16 (36)	12 (67)	1 (6)
- Incorrect	113 (48)	20 (46)	3 (17)	14 (82)
- I don't know	0 (0)	0 (0)	0 (0)	0 (0)
- Missing response	46 (19)	8 (18)	3 (17)	2 (12)

560 \*Median [Q1–Q3]; LH= Luteinising hormone; FSH= follicle stimulating hormone; Data are presented as n (%).

**Table 3: Perspectives and attitudes of African women football players towards the menstrual cycle and menstruation (n=238)**

Questions	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Missing responses
A woman's performance in sports is not affected negatively by menstruation.	48 (20.2)	49 (20.6)	41 (17.2)	61 (25.6)	28 (11.8)	11 (4.6)
Menstruation is something women just have to put up with.	73 (30.7)	103 (43.3)	26 (10.9)	10 (4.2)	9 (3.8)	17 (7.1)
Menstruation is a recurring affirmation of womanhood.	80 (33.6)	108 (45.4)	8 (3.4)	7 (2.9)	9 (3.8)	26 (10.9)
A woman can tell that their period is approaching because of breast tenderness, backache, cramps, or other physical signs.	114 (47.9)	100 (42.0)	6 (2.5)	9 (3.8)	0 (0)	9 (3.8)
Most women show a weight gain just before or during menstruation.	32 (13.4)	89 (37.4)	44 (18.5)	44 (18.5)	18 (7.6)	11 (4.6)
Women are more tired than usual when they are menstruating.	58 (24.4)	101 (42.4)	36 (15.1)	24 (10.1)	10 (4.2)	9 (3.8)
Women expect extra consideration from friends when they are menstruating.	32 (13.4)	74 (31.1)	57 (23.9)	44 (18.5)	10 (4.2)	21 (8.8)
In some ways women enjoy menstrual periods.	9 (3.8)	40 (16.8)	57 (23.9)	67 (28.2)	44 (18.5)	21 (8.8)
Menstruation provides a way for women to keep in touch with their body.	47 (19.7)	118 (49.6)	30 (12.6)	16 (6.7)	7 (2.9)	20 (8.4)
Women have learned to anticipate their menstrual period by the mood changes which precede it.	69 (29.0)	116 (48.7)	20 (8.4)	14 (5.9)	4 (1.7)	15 (6.3)
Other people should not be critical of a woman who is easily upset before or during her menstrual period.	62 (26.1)	110 (46.2)	22 (9.2)	23 (9.7)	3 (1.3)	18 (7.6)
The physiological effects of menstruation are normally no greater than other usual fluctuations in physical state.	24 (10.1)	60 (25.2)	65 (27.3)	52 (21.8)	10 (4.2)	27 (11.3)
Men have a real advantage in not having the monthly interruption of a menstrual period.	83 (34.9)	83 (34.9)	38 (16.0)	12 (5.0)	6 (2.5)	16 (6.7)
A woman's own moods are not influenced in any major way by the phase of the menstrual cycle.	33 (13.9)	40 (16.8)	41 (17.2)	71 (29.8)	36 (15.1)	17 (7.1)
Periods/Menstrual cramps are bothersome only if a woman pays attention to them.	34 (14.3)	57 (23.9)	37 (15.5)	52 (21.8)	44 (18.5)	14 (5.9)
Menstruation can negatively affect women's performance in sports.	51 (21.4)	76 (31.9)	43 (18.1)	27 (11.3)	25 (10.5)	16 (6.7)
Women feel as fit during menstruation as they do during any other time of the month.	36 (15.1)	49 (20.6)	47 (19.7)	69 (29.0)	19 (8.0)	18 (7.6)

Women hope it will be possible someday to get a menstrual period over within a few minutes.	63 (26.5)	74 (31.1)	28 (11.8)	32 (13.4)	18 (7.6)	23 (9.7)
Menstruation is an obvious example of the rhythmicity that pervades all of life.	40 (16.8)	82 (34.5)	54 (22.7)	17 (7.1)	8 (3.4)	37 (15.5)
A woman who attributes her irritability to her approaching menstrual period is psychologically disturbed.	39 (16.4)	59 (24.8)	41 (17.2)	31 (13.0)	41 (17.2)	27 (11.3)
Women barely notice the minor effects of their menstrual periods on their body.	40 (16.8)	80 (33.6)	29 (12.2)	44 (18.5)	23 (9.7)	22 (9.2)
Women don't allow the fact that they are menstruating to interfere with their usual activities.	65 (27.3)	89 (37.4)	33 (13.9)	26 (10.9)	6 (2.5)	19 (8.0)
Menstrual periods do not affect how well women do on intellectual tasks.	56 (23.5)	72 (30.3)	36 (15.1)	38 (16.0)	11 (4.6)	25 (10.5)
Avoiding certain activities during menstruation is often very wise.	47 (19.7)	78 (32.8)	32 (13.4)	37 (15.5)	11 (4.6)	33 (13.9)
The only thing menstruation is good for is to let a woman know that she is not pregnant.	54 (22.7)	80 (33.6)	27 (11.3)	27 (11.3)	26 (10.9)	24 (10.1)
Women who complain of menstrual distress such as cramps are just using that as an excuse.	21 (8.8)	17 (7.1)	29 (12.2)	69 (29.0)	75 (31.5)	27 (11.3)
Women are more easily upset during premenstrual or menstrual periods than at other times of the month.	57 (23.9)	97 (40.8)	25 (10.5)	20 (8.4)	7 (2.9)	32 (13.4)
Women cannot expect as much of themselves during menstruation compared to the rest of the month.	40 (16.8)	84 (35.3)	38 (16.0)	33 (13.9)	10 (4.2)	33 (13.9)
The recurrent monthly flow of menstruation is an external indication of a woman's general good health.	53 (22.3)	82 (34.5)	32 (13.4)	28 (11.8)	10 (4.2)	33 (13.9)
Premenstrual tension/irritability is all in a woman's head.	15 (6.3)	57 (23.9)	43 (18.1)	43 (18.1)	44 (18.5)	36 (15.1)
Women just have to accept the fact that they may not perform as well when they are menstruating.	38 (16.0)	66 (27.7)	32 (13.4)	46 (19.3)	27 (11.3)	29 (12.2)
Most women make too much of the minor physiological effects of menstruation.	25 (10.5)	62 (26.1)	60 (25.2)	37 (15.5)	18 (7.6)	36 (15.1)
Menstruation is a curse/ causes bad luck	10 (4.2)	10 (4.2)	18 (7.6)	67 (28.2)	98 (41.2)	35 (14.7)
Women should not tell anyone about their periods, they should be a woman's secret	25 (10.5)	36 (15.1)	27 (11.3)	65 (27.3)	61 (25.6)	24 (10.1)
Menstruation is a contagious condition	12 (5.0)	36 (15.1)	29 (12.2)	47 (19.7)	80 (33.6)	34 (14.3)
Menstruation is a shameful condition	16 (6.7)	16 (6.7)	15 (6.3)	57 (23.9)	101 (42.4)	33 (13.9)
For convenience, the menstrual cycle should be changed by drugs (e.g. contraceptives like the pill)	20 (8.4)	23 (9.7)	29 (12.2)	59 (24.8)	74 (31.1)	33 (13.9)

Data are presented as n (%).

**Table 4:** Behaviours of African women football players, coaches, health personnel, and referees towards the menstrual cycle and menstruation (n=317).

Questions/Responses	Players (n=238)	Coaches (n=44)	Health personnel (n=18)	Referees (n=17)
<b>Have you completed any courses/training on the female reproductive system or menstrual cycle?</b>				
- Yes	53 (22.3)	9 (20.5)	7 (38.9)	6 (35.3)
- No	140 (58.8)	28 (63.6)	8 (44.4)	9 (52.9)
- I don't remember/I'm not sure	22 (9.2)	4 (9.1)	2 (11.1)	2 (11.8)
- Missing responses	23 (9.7)	3 (6.8)	1 (5.6)	0 (0)
<b>Is education/training relating to the menstrual cycle provided for you at your team/squad?</b>				
- Yes	59 (24.8)	8 (18.2)	5 (27.8)	4 (23.5)
- No	130 (54.6)	27 (61.4)	11 (61.1)	11 (64.7)
- I'm not sure	21 (8.8)	5 (11.4)	1 (5.6)	1 (5.9)
- Missing responses	28 (11.8)	4 (9.1)	1 (5.6)	1 (5.9)
<b>Where do/did you get your information on the menstrual cycle?</b>				
- Teammate	17 (7.1)	1 (2.3)	0 (0)	0 (0)
- Friend	29 (12.2)	3 (6.8)	0 (0)	1 (5.9)
- Family member	78 (32.8)	16 (36.4)	2 (11.1)	5 (29.4)
- School	75 (31.5)	6 (13.6)	4 (22.2)	2 (11.8)
- Coach	6 (2.5)	0 (0)	0 (0)	0 (0)
- Team/squad physiotherapist	7 (2.9)	0 (0)	0 (0)	1 (5.9)
- Team/squad doctor	18 (7.6)	4 (9.1)	0 (0)	0 (0)
- Team/squad welfare manager	2 (0.8)	3 (6.8)	0 (0)	0 (0)
- Team/squad strength and conditioning coach	0 (0)	0 (0)	0 (0)	0 (0)
- Personal doctor/physiotherapist	16 (6.7)	0 (0)	4 (22.2)	2 (11.8)
- Scientific literature	8 (3.4)	7 (15.9)	3 (16.7)	0 (0)
- Web resources	42 (17.6)	9 (20.5)	3 (16.7)	3 (17.6)
- Other sources	6 (2.5)	3 (6.8)	1 (5.6)	0 (0)
- Missing responses				
<b>Does your team/squad provide menstrual products?</b>				
- Yes	125 (52.5)	22 (50.0)	7 (38.9)	1 (5.9)
- No	72 (30.3)	15 (34.1)	9 (50.0)	12 (70.6)
- I'm not sure	18 (7.6)	4 (9.1)	0 (0)	3 (17.6)
- Missing responses	23 (9.7)	3 (6.8)	2 (11.1)	1 (5.9)



<b>Do you feel comfortable/confident with your knowledge of the menstrual cycle?</b>				
- Not at all confident/comfortable	37 (15.5)	2 (4.5)	2 (11.1)	4 (23.5)
- Somewhat confident/comfortable	54 (22.7)	12 (27.3)	2 (11.1)	2 (11.8)
- Confident/comfortable	92 (38.7)	21 (47.7)	13 (72.2)	7 (41.2)
- Extremely confident/comfortable	25 (10.5)	5 (11.4)	0 (0)	3 (17.6)
- Missing responses	30 (12.6)	4 (9.1)	1 (5.6)	1 (5.9)
<b>How comfortable/confident are you talking about the menstrual cycle in your team/squad?</b>				
- Not at all confident/comfortable	35 (14.7)	7 (15.9)	2 (11.1)	2 (11.8)
- Somewhat confident/comfortable	54 (22.7)	11 (25.0)	3 (16.7)	4 (23.5)
- Confident/comfortable	79 (33.2)	15 (34.1)	8 (44.4)	4 (23.5)
- Extremely confident/comfortable	43 (18.1)	8 (18.2)	4 (22.2)	6 (35.3)
- Missing responses	27 (11.3)	3 (6.8)	1 (5.6)	1 (5.9)
<b>How comfortable/confident are you providing advice about the menstrual cycle in your team/squad?</b>				
- Not at all confident/comfortable	31 (13.0)	2 (4.5)	1 (5.6)	3 (17.6)
- Somewhat confident/comfortable	53 (22.3)	10 (22.7)	3 (16.7)	4 (23.5)
- Confident/comfortable	78 (32.8)	18 (40.9)	8 (44.4)	4 (23.5)
- Extremely confident/comfortable	47 (19.7)	9 (20.5)	5 (27.8)	3 (17.6)
- Missing responses	29 (12.2)	5 (11.4)	1 (5.6)	3 (17.6)
<b>Do you think it would be beneficial to receive training on the menstrual cycle and sporting performance?</b>				
- Not at all beneficial	14 (5.9)	1 (2.3)	0 (0)	0 (0)
- Somewhat beneficial	15 (6.3)	2 (4.5)	0 (0)	2 (11.8)
- Beneficial	100 (42.0)	7 (15.9)	5 (27.8)	7 (41.2)
- Extremely beneficial	83 (34.9)	30 (68.2)	12 (66.7)	7 (41.2)
- Missing responses	26 (10.9)	4 (9.1)	1 (5.6)	1 (5.9)

Data are presented as n (%).

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## **Conflict of interests declarations**

AS is a medical researcher at FIFA; NSM and KOK are technical consultants with FIFA.

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## **Ethics approval**

The study was approved by the Faculty of Medicine Research Ethics Committee, Midlands State University, Zimbabwe (MSUFMEC 0008/09/21).

## **Data sharing statement**

Individual, de-identified data collected in the study will be made available following publication, for aims approved in the proposal and upon reasonable request to the corresponding author on

[nonhlanhla.mkumbuzi@northumbria.ac.uk](mailto:nonhlanhla.mkumbuzi@northumbria.ac.uk). These data will be available for 3 years after publication.