Manchester Metropolitan University

e-space

Manchester Metropolitan University's Research Repository

Please cite the Published Version

Kolić, Petra V, Sims, David T, Hicks, Kirsty, Thomas, Laura and Morse, Christopher I (2021) Physical Activity and the Menstrual Cycle: A Mixed-Methods Study of Women's Experiences. Women in Sport and Physical Activity Journal, 29 (1). pp. 47-58. ISSN 1063-6161

DOI: https://doi.org/10.1123/wspaj.2020-0050

Publisher: Human Kinetics

Version: Accepted Version

Downloaded from: https://e-space.mmu.ac.uk/627428/

Usage rights: © In Copyright

Additional Information: Author accepted manuscript published by and copyright 2021 Human Kinetics.

Enquiries:
If you have questions about this document, contact openresearch@mmu.ac.uk. Please include the URL of the record in e-space. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from https://www.mmu.ac.uk/library/using-the-library/policies-and-guidelines)

Physical activity and the menstrual cycle: A mixed-methods study of women's experiences.

Petra V. Kolić[a]*, David T. Sims[a], Kirsty Hicks[b], Laura Thomas[c] and Christopher I. Morse[a]

[a]*Department of Sport and Exercise Sciences, Manchester Metropolitan University, Manchester, United Kingdom (UK);* [b]*Department of Sport, Exercise & Rehabilitation, Northumbria University, Newcastle, UK;* [c]*School of Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, UK*

*Corresponding author. Department of Sport and Exercise Sciences, Manchester Metropolitan University, Oxford Road, Manchester M15 6BH, UK. Email: P.Kolic@mmu.ac.uk. ORCiD ID: https://orcid.org/0000-0003-3402-1857

This article is presented as the Pre-print green open access. The published article can be found here: Kolić, P.V., Sims, D.T., Hicks, K., Thomas, L. and Morse, C.I., 2021. Physical Activity and the Menstrual Cycle: A Mixed-Methods Study of Women's Experiences. Women in Sport and Physical Activity Journal, 1(aop), pp.1-12. DOI: https://doi.org/10.1123/wspaj.2020-0050

Physical activity and the menstrual cycle: A mixed-methods study of women's experiences.

The menstrual cycle is an important biological process in women that is associated with a range of physical symptoms, which can shape how women think, feel, and participate in activities of daily life. This study employed a mixed-methods design to investigate adult women's physical activity throughout the menstrual cycle. One hundred and twenty-eight participants completed online questionnaires that explored events of the menstrual cycle (e.g., bleeding, pain, fatigue) and physical activity. Semi-structured interviews with 21 questionnaire respondents unpacked individual experiences of physical activity throughout the menstrual cycle. From the questionnaire data, 44 participants were categorised as avoiders and 84 as non-avoiders of physical activity due to menstrual events. Avoiders of physical activity reported longer periods, heavier menstrual flow, higher levels of fatigue and pain compared to non-avoiders. Interviews revealed that avoidance of physical activity ranged from complete avoidance to adaptation (e.g., types of exercise). Reasons for avoidance and adaptation of physical activity included menstrual symptoms, personal thoughts, and concerns about other people's views of the period. The present study findings emphasise the importance of recognising women's individual perspectives and established societal norms in addition to physical symptoms in order to better understand and normalise physical activity throughout the menstrual cycle.

Keywords: menstruation; period; questionnaire; interview; symptoms; avoidance; self

Introduction

The menstrual cycle is a natural process in women's reproductive years that represents a highly individual and personal experience (Brantelid et al., 2014). The start of every menstrual cycle is marked by the period, also known as menstruation, which can lead to symptoms, such as bleeding (Santer et al., 2007, 2008), pain (Chen & Hu, 2019), mood changes (Samy et al., 2019), lethargy and fatigue (Bruinvels et al., 2016). The symptoms can extend beyond the period and throughout the entire menstrual cycle and affect how women feel and think about their bodies (Chrisler et al., 2015; Spadaro et al., 2018). How women feel, think, and act is framed further by normative expectations, stereotypes, and myths about the menstrual cycle (Kowalski & Chapple, 2000; Marván et al., 2006). A combination of menstrual symptoms, women's thoughts and feelings, and social norms could contribute to changes in activities of daily life (Brantelid et al., 2014; Chen et al., 2016; Houston et al., 2006).

The most commonly reported menstrual symptoms represent painful cramps (dysmenorrhea) and tiredness (Schoep et al., 2019), as well as heavy bleeding (Bruinvels et al., 2016). On days of the period, the burden of these symptoms has been shown to prevent women from participating in daily activities (Schoep et al., 2019). For instance, 43% of adolescent women avoided aspects of daily life due to menstrual events (e.g., bleeding and pain) of which 21% missed at least one in 30 school days (Houston et al., 2006). Similarly, 64% of adult women missed an average of 2.6 workdays per month due to severe menstrual bleeding and pain (Fourquet et al., 2010). Aside from the severity of menstrual symptoms, women's behaviour changes could be shaped by upbringing (Marván & Molina-Abolnik, 2012), education (Stubbs, 2008), and media coverage (e.g., advertisements) (Spadaro et al., 2018). Presentations of the period as a matter of secrecy led women to be vigilant, self-conscious, and selective of daily

activities they undertook and avoided (Johnston-Robledo & Chrisler, 2013). Beyond daily activities, however, limited studies have investigated how women experienced and perceived the menstrual cycle and its impact on sporting performance (Findlay et al., 2020; Moreno-Black & Vallianatos, 2005). A study conducted by Moreno-Black and Vallianatos (2005) with first-year students, who had a history of sport participation, found that women associated menstruation with shame and therefore disguised any associated signs (e.g., sanitary product). The participants were concerned and anxious about the visibility of menstruation (e.g., through leakage) and subsequent, negative public attention. Such negative connotations were perpetuated by comments from parents, teammates, and coaches of young women (Moreno-Black & Vallianatos, 2005). Similarly, Findlay et al.'s (2020) study with international rugby players demonstrated that athletes were highly aware and, at times, worried about the impact of their menstrual symptoms on performance. Although severe symptoms, such as dysmenorrhea, limited the participants during strenuous exercise (e.g., high intensity training), the athletes had established coping strategies (e.g., by accepting their menstrual experience or adapting to it), they had sought advice from medical professionals to manage menstrual symptoms, and spoke to trusted others to process their experiences of the menstrual cycle (Findlay et al., 2020). There remains no comparison, however, how physical activity in a non-athlete population might be affected by not only menstrual symptoms, but also women's individual experiences and social understandings of the menstrual cycle.

Identifying that there is no extent data on the menstrual impact of physical activity, broader comparisons could be made with examples from the effect of pregnancy, adult life transitions, and body awareness on physical activity. In physically active women, who adapted routines throughout pregnancy, decisions whether to

participate in physical activity and, if so, to which extent, depended on the nature and severity of pregnancy-related symptoms (e.g., nausea, fatigue, backache), as well as women's perceptions of their own pregnancy and social expectations regarding physical activity throughout pregnancy (Cioffi et al., 2010). Women self-managed the type, intensity, and amount of physical activity they undertook, thoroughly evaluating societal expectations, information received from health professionals, and myths that relatives and friends shared with them (Cioffi et al., 2010). Similarly, a survey with 14,779 women aged 18–23 years showed that marriage and motherhood, both significant transitions in adult life, put pressure on the time available for physical activity and led to an increase in inactivity (Brown & Trost, 2003). Comparably, body consciousness and the awareness of social norms regarding a desirable body image led women to avoid physical activity (Markland, 2009). The perceived pressure to look a certain way and comparisons to other women in physical activity settings reduced already deflated levels of body satisfaction and affected drop out from physical activity (Pridgeon & Grogan, 2012). This drop out is concerning as it has been shown that physical activity could have a positive effect on dysmenorrhea (Dehnavi et al., 2018) and self-esteem (Zamani Sani et al., 2016).

Within the United Kingdom (UK), 15% fewer women than men aged 16-34 meet aerobic exercise guidelines and 47% of young adult women undertake no structured exercise compared to 32% of men (NHS Digital, 2017). Barriers to physical activity are multifactorial and the lower level of daily physical activity in women could be attributed to numerous factors. It is however impossible to discount that the menstrual cycle, known to influence other aspects of daily life (e.g., school [Houston et al., 2006], work attendance [Fourquet et al., 2010]), may account in part for lower physical activity in women compared to men. One approach to determining whether

116 physical activity is impacted by the menstrual cycle is to combine quantitative and
117 qualitative methodology and facilitate a holistic understanding of the quantifiable (e.g.,
118 pain and flow) and the personal (e.g., experiences and perceptions) (Santer et al., 2007;
119 2008). Within the context of limited qualitative studies in athletic populations (Findlay
120 et al., 2020; Moreno-Black & Vallianatos, 2005), there remains no broader analysis of
121 physical activity and the menstrual cycle in the general population. The aim of this
122 study was therefore to, (1) quantify events of the menstrual cycle and self-reported
123 physical activity avoidance in women and (2) understand women's lived experiences of
124 physical activity throughout the menstrual cycle. The use of mixed methodology was
125 envisaged to aid an in-depth understanding of the multi-facetted factors affecting
126 physical activity throughout the menstrual cycle, which could usefully inform physical
127 activity recommendations and agendas. We hypothesise based on the avoidance of
128 school (Houston et al., 2006), work (Fourquet et al., 2010) and elite athlete training
129 commitments (Findlay et al., 2020), that women in the present study will show
130 avoidance of physical activity as a result of menstrual events.

131

132 **Methodology**

133 ***Design***

134 The authors utilised a mixed-methods design for the purpose of which they adopted a
135 pragmatic research positioning in line with Morgan (2007). Within this view, emphasis
136 is on (1) drawing on the strengths of quantitative and qualitative methods, (2) following
137 an abductive research process, and (3) acknowledging intersubjectivity. In the present
138 study, quantitative research methods were utilised to quantify the extent to which
139 women experienced menstrual symptoms and participated in physical activity while the

use of qualitative research methods gave insight into the different ways in which individual experiences of the menstrual cycle affected women's physical activity. By working back and forth between quantitative and qualitative components of this study, the authors followed an abductive research process in line with Morgan (2007). Finally, equal value was placed on the worldviews of the research team members, who recognised and accepted that their individual interpretations about "one world" might differ (Morgan, 2007). In doing so, the authors sought to aid the development of the research (Sandelowski, 2000) and the comprehensiveness of the study findings (O'Cathain, 2010).

A questionnaire was developed to examine the frequency and extent of menstrual events as well as self-reported physical activity throughout the menstrual cycle. Semi-structured interviews explored in-depth women's individual experiences and meanings of physical activity and the menstrual cycle (Creswell et al., 2010). Figure 1 visualises how the quantitative and qualitative components were prepared, utilised, and integrated.

To ensure research quality, the researchers employed traditional and alternative criteria (Bryman et al., 2008) and aligned their thinking with the integrative framework by Tashakkori and Teddlie (2008). For design quality, focus was on the suitability and adequacy of research design and methods, on whether the study components flowed in a sound manner, and whether the strategies for data analysis were appropriate to meet the research aims. To achieve interpretive rigor, it was of importance to engage in critical debate and to seek interpretive agreement in the research team, to ensure distinctiveness of interpretations, and adequate integration of quantitative and qualitative results. Finally, the transferability of quantitative and qualitative results into other contexts and

participant groups was prioritised over rigid emphasis on generalisability or context-dependence of the study results (see discussion).

Insert figure 1 here.

Participants

Following ethical approval from the Institution Review Board, participant recruitment took place via social media (Twitter and Facebook) and leaflets, which were distributed at fitness centres affiliated to the authors' universities by the research team. The authors sought to gain a broad understanding of physical activity and the menstrual cycle from women in the generic population, however, equally adopted a purposeful recruitment strategy, as only women of menstruating age were eligible for participation (Collins, 2010). This approach proved successful as patterns were later observed in the data gathered from the study participants. The recruitment process led to a sample of 128 women of multiple races and ethnicities (27.9 (7.5) years, 1.65 (0.06) m, 63.2 (12.2) Kg, Table 1), who completed the online questionnaire. Through the questionnaire, 82 of 128 participants provided consent to be contacted for further research participation and of these, 38 shared their contact information (email address).

The 38 questionnaire respondents, who had provided contact details, were then invited to a follow-up interview and 21 women took part in interviews. All of whom completed the online questionnaire first and then participated in an interview. Interview invitations and interviews themselves were led by the principal author, one of the female researchers on the team, to facilitate the establishment of rapport and trust

(Miller, 2017), which was considered important to intimate discussions about the menstrual cycle (Dempsey et al., 2016). Interviews were conducted at times and locations that were not only convenient, but also facilitated comfort between her and the participants. Everyone, who stepped forward for an interview, was interviewed and as the final interviews were arranged, saturation had been reached and the research team were confident to halt data collection (Beitin, 2012).

Data collection

Questionnaire

For the purpose of this research, participants completed a questionnaire about their menstrual cycle duration, menstrual flow, pain or discomfort, and lethargy, combined with questions related to exercise avoidance and self-reported physical activity status. All aspects of the questionnaire were completed online (Jisc, UK). Informed consent was obtained via a compulsory drop down selection at the start of the questionnaire, which was presented following a participant information page. Those who responded to "I do not provide consent for my answers to be used in research" were directed to an exit page of the questionnaire. All questions required a compulsory answer, however two participants selected "not applicable" for their self-reported body mass, which is therefore presented from N = 126. The questionnaire was developed adopting aspects of previous studies that had reported menstrual symptoms, including items from the Menstrual Bleeding Questionnaire (3 items, Matteson et al., 2015), assessment of menstrual pain (1 item, Larroy, 2002), and menstrual flow heaviness (1 item, Fraser et al., 2015).

Participant demographics

Participants completed drop-down selections for age (yrs), height and body mass. Options were given for the height in metres and feet and inches, and for body mass in kg and lbs.

Hormonal contraceptive

Participants were given the option of seven choices related to their use of hormonal contraceptive, from “none” to different forms of hormonal contraceptives, such as oral contraceptive pill (including type and exogenous hormone dosage), patch, injection, or intrauterine devices. For the purpose of data analysis, they are classified as: “None” if they use no form of hormonal contraceptive, “Pill” if they use any form of oral contraceptive, and “non-oral contraceptive” if they use any form of indwelling, injected or cutaneous hormonal contraceptive.

Menstrual events

Participants were asked “Over the last three months, roughly how many days on average has your period lasted?”; these data are reported in the present results as “length of period”. In addition, participants completed a calendar style grid for the symptoms experienced throughout the month for: “bleeding”, “spotting”, “discomfort, cramps or pain” and “lethargy and fatigue”. Within the questionnaire, each of these menstrual

symptoms contained a more detailed description. Participants were instructed to select the days of the month when these symptoms normally occur, with specific reference to the previous month. The frequency of each symptom was summed throughout the month and is presented below as the number of days each symptom occurs during a menstrual cycle (days/MC). Although reliability data is available on retrospective recall for some elements of the menstrual cycle, for instance 80% of women are able to recall their last period date with two days of accuracy (Wegienaka & Baird, 2005) and menstrual cycle length is underestimated by one day compared to using prospective logging (29.4 and 30.9 days, respectively [Small et al., 2007]), the reliability of recalling period length as described above is not presently reported. There is however, "excellent agreement" between daily compared to 1-month recall for menstrual symptoms of bleeding heaviness and pain (Matteson et al., 2015), with the risk of recall bias on these specific elements of the Menstrual Bleeding Questionnaire being described by those authors as "not a problem". It should also be noted that 52% of our participants self-reported that they tracked their menstrual and pre-menstrual events through an App or diary, and 88% reported that they were somewhat or very confident that they "can accurately recall [their] menstrual cycle dates and pre-menstrual symptoms".

Heavy or normal menstrual bleeding

Participants were classified as "heavy" menstrual bleeders based on the selection of two or more of the following symptoms, consistent with Fraser et al. (2015): 1) a need for double sanitary products (e.g., tampons and towels) at the same time, 2) a need for frequent changes of sanitary towels or tampons (every two hours or less, or 12 sanitary

items per day), 3) bleeding through sanitary products onto clothes or bedding, and 4) the presence of large clots within period blood. A final option of "none of the above" was also included. Participants reporting one or none of the above symptoms were classified as "normal" menstrual bleeders (Fraser et al., 2015). These terminologies are consistent with the International Federation of Gynecology and Obstetrics (FIGO) systems for nomenclature of symptoms of normal and abnormal uterine bleeding (Fraser et al., 2011). Despite the accepted terminology and classification of heavy menstrual bleeding, there is presently no reliability data available for the classification of "heavy menstrual bleeding" as established by Fraser et al. (2015). Concurrent validity has however been previously reported based on menstrual symptom severity being higher in women who are classified as experiencing heavy compared to normal menstrual bleeding (Matteson et al., 2015), with daily and monthly flow scores showing excellent agreement (ρ = 0.82, Matteson et al., 2015).

Pain

Participants were provided with a numerical scale from 0-10 (Larroy, 2002), where 0 was labelled "no pain", 5 was labelled "moderate pain" and 10 was labelled "worst possible pain". Within the questionnaire, a visual analogue scale was also provided under "more info". Participants were classified into "mild pain" if pain was between 1 and 3, "moderate pain" between 4 and 7 points, and "severe pain" between 8 and 10 points (Kural et al., 2015). Due to there being insufficient "avoider" participants (see below) falling within the "no pain" category, the "no-pain" and "mild pain" were compressed into a "no-to-mild pain" category representing all participants reporting pain of ≤3. Analysis of menstrual pain was conducted based on both continuous data

279 from the numerical scale (termed pain severity, Table 1), and pain classification.

280

281 Avoidance

282 Participants were asked “In the last 3 months, which, if any, of the following activities
283 have you avoided or postponed due to menstrual events or discomfort?” with the
284 options provided of “social activities”, “work or university”, “playing sport, going to the
285 gym, or other physical activities” and “none”. An open text option of “other” was also
286 provided. Where these included recreational activities such as “swimming”, “walking”
287 or “hiking” they were categorised in the “physical activity” avoidance response if this
288 was not already marked in the affirmative. Due to the focus of the present study,
289 participants were classified as “avoiders” and “non-avoiders” based on whether they
290 had reported to have previously avoided physical activity due to the events of the
291 menstrual cycle. The impact of menstrual symptoms on physical activity avoidance was
292 based on similar single question components of absenteeism from work and school
293 (Fourquet et al., 2010; Houston et al., 2006).

294

295 Physical activity

296 Self-reported physical activity status was assessed based on the following criteria:
297 sedentary (walking less than 20 mins a day); slightly active (walk over 20 mins per
298 day); moderately active (undertake at least 20 mins of moderate physical activity per
299 day); very active (undertake 40 mins of moderate intensity physical activity per day);
300 athlete (high intensity exercise 5+ days a week). For the purpose of subsequent analysis,

as there were fewer than five participants within the sedentary and athlete categories, the groups were condensed with their closest categories. The physical activity classifications were therefore: sedentary-to-low activity, moderately active, high activity-to-athlete. Despite retrospective recall having known limitations for accurately quantifying daily physical activity (Lee et al., 2011), a single item physical activity question is a valid approach for the purposes of participant classification as adopted in the present study (Milton et al., 2013; Schechtman et al., 1991), with high test-retest reliability (r = 0.82, Milton et al., 2011).

Interviews

Semi-structured interviews were conducted to (1) expand on the data obtained from questionnaires (O'Cathain, 2010), (2) to facilitate the generation of new ideas that might not have emerged from the sole use of quantitative methodology, and (3) to uncover the subtleties underpinning participant perceptions 'in diverse and enriched ways' (Smith & Sparkes, 2016, p. 3). They were useful to cover aspects important to the inquiry, while rendering the flexibility to pose impromptu questions that encouraged participants to express thoughts freely (Brinkmann & Kvale, 2018).

In this study, 21 interviews were conducted, of which seven took place face-to-face and 14 via video call (FaceTime or WhatsApp). Prior to interview participation, the women gave written consent to voluntary interview participation, to audio recording of interviews, to transcription of these audio recordings, and to the use of anonymised, direct quotes in published work (e.g., conference presentations, journal articles). Interviews were informed by an interview guide, which outlined topics of interest and example questions. Following a summary by the principal author of the purpose of

interviews, conversations then focused on understanding women's physical activity throughout the menstrual cycle (Warren, 2012). Interview questions explored how the participants felt on days before, during, and after the period, what the participants' physical activity looked like throughout the menstrual cycle, how participants felt about themselves throughout the menstrual cycle, how menstrual symptoms, self-perceptions, and social situations shaped physical activity on days of the period, and why the participants thought, felt, and acted in certain ways. Participants were prompted to expand on initial thoughts with questions, such as "How did this make you feel?", "Why do you think this way?" or "Can you give me an example?" Interviews were audio-recorded and transcribed by the principal author for further interpretation (Davidson, 2009).

Data analysis

Questionnaire

All quantitative analyses were performed using IBM SPSS Statistics 24 software. Where appropriate (i.e. ratio data), parametric assumptions of normal distribution were confirmed using Shapiro-Wilk's test ($p>0.05$) in all dependent variables, except for height in both avoiders and non-avoiders ($p<0.05$). Group comparisons were made using independent t-tests with equal variance (Levene's, $p>0.05$) in all dependent variables, other than pain (days/MC), fatigue (days/MC), and spotting (days/MC) (Levene's $p<0.05$). For comparison of group differences in height, the Mann-Whitney U test was performed. All data are presented as mean (SD), with group differences reported as: p, 95% confidence interval (CI) and effect size (d).

348 Nominal data was assessed using Chi-square associations for classifications of
349 pain, flow, contraception, and physical activity. Participants were grouped as avoiders
350 or non-avoiders, with subsequent post-hoc analysis performed if the Chi-square reached
351 significance (p<0.05, for pain and flow). As only two classification were made for flow,
352 no post hoc was necessary. Whereas for pain, there were three classifications (no-mild,
353 moderate, and severe), in this instance cell-wise residual analysis was performed
354 (Garcia-Perez & Nunez-Anton, 2003), with the level of significance adjusted for the
355 three sub-classifications. For the nominal variables, a significant outcome of Chi square
356 is described as a significant association rather than a group difference based on previous
357 recommendations (Field, 2013; McHugh, 2013; Scott et al., 2013).

358

359 *Interviews*

360 Thematic analysis was utilised to identify patterns in the interview data and make sense
361 of their meaning (Braun et al., 2016). The principal author read anonymised interview
362 transcripts recurrently to define codes, which constituted of links between data and
363 ideas, and themes that helped identify commonalities and distinctions (Nowell et al.,
364 2017). She recognised this phase as an active process of meaning making and adopted
365 an iterative approach by working "back and forth" between interview data, preliminary
366 themes, and interpretations (Braun et al., 2016). Analytical questions included "What do
367 the participants' physical activity routines look like?", "How do menstrual events affect
368 the participants' physical activity? Why is this so?", "How do the participants think and
369 feel about factors affecting physical activity? Why do they think and feel in certain
370 ways?" To strengthen the credibility of interpretations, the principal author liaised with
371 members of the research team, who acted as critical friends and discussed

372 interpretations, prompted reflection, and explored interpretive avenues (Smith &
373 McGannon, 2018). In the latter stages of analysis and write-up, the dialogues also
374 explored opportunities to integrate the insights gained from questionnaires and
375 interviews to develop rich discussions of physical activity and the menstrual cycle.

376

377 **Results**

378 ***Questionnaire results***

379 Of the 128 responders, 44 participants (34%) were classified as "avoider" and 84
380 participants (66%) were classified as "non-avoider" based on whether they had avoided
381 playing sport, going to the gym, or other physical activities due to their menstrual
382 events or discomfort.

383

384 *Participant demographics*

385 There was no significant difference in age, height or body mass between avoiders and
386 non-avoiders (Table 1).

387

388 *Menstrual characteristics*

389 Compared to non-avoiders, avoiders had periods that lasted 0.65 days longer ($t(126) = -$
390 2.34, $p<0.05$, CI [0.10, 1.20], $d = 0.40$, Table 1). In terms of specific menstrual
391 symptoms, compared to non-avoiders over the course of a menstrual cycle, avoiders had
392 0.94 more days of bleeding ($t(126) = -2.464$, $p<0.05$, CI [0.18, 1.71], $d = 0.46$), 0.98

more days of fatigue ($t(126) = -4.769$, $p<0.01$, CI [1.30, 3.61], $d = 0.33$) and 2.44 more days of pain ($t(126) = -4.191$, $p<0.01$, CI [1.28, 3.61], $d = 0.84$, Table 1). There was no difference in days of spotting between avoiders and non-avoiders (Table 1).

Pain severity (numerical scale) was 62% higher in avoiders than non-avoiders ($t(126) = -4.116$, $p<0.01$, CI [1.09, 2.96], $d = 0.78$, Table 1). There was no significant association between contraception use and physical activity avoidance (X^2 (2, N =128) = 2.06, p=0.35); with 61% and 57% using no form of hormonal contraceptive, 18.2% and 11.9% using non-oral contraceptive, and 20.5% and 31% using some form of oral contraceptive pill, in avoiders and non-avoiders, respectively.

There was no significant association between physical activity classification and avoidance (X^2 (2, N = 128) = 2.73, p=0.26), with 20.5% avoiders and 11.9% non-avoiders being sedentary or low physical activity, 54.5% avoiders and 51.2% non-avoiders being active, and 25% avoiders and 36.9% non-avoiders being very active or athlete.

There was a significant association between pain classification and avoidance (X^2 (2, N = 128) = 14.5, $p<0.01$). Post hoc revealed that significantly less avoiders were in the "no-to-mild" pain classification (20.5%) than non-avoiders (52.4%, $p<0.01$). Similar participant numbers were found for avoiders and non-avoiders in the moderate pain classification (59.1% avoiders, and 41.7% of non-avoiders), and in the severe pain classification (20.5% of avoiders and 6% of non-avoiders, $p<0.04$, no significant difference at the adjusted $\alpha = p<0.017$).

There was a significant association between menstrual flow and avoidance (X^2 (1, N = 128) =22.3, $p< 0.01$), 63.6% of avoiders were classified as heavy flow, compared to 21.4% of non-avoiders. Similarly, 36.4% of avoiders were classified as normal flow compared to 78.6% of non-avoiders.

418

419 Insert table 1 here.

420

421 ***Interview results***

422 Following on from the questions posed throughout the data analysis, the results explore
423 women's experiences and management of physical activity as well as factors affecting
424 physical activity throughout the menstrual cycle, including menstrual symptoms,
425 personal perspectives, and social expectations. Throughout this section, pseudonyms
426 were used to protect the identity of participants.

427

428 *Periods and physical activity: Realities and experiences*

429 The women, who took part in interviews, spoke openly about the menstrual cycle and
430 shared personal experiences. Although participants referred to the period as the
431 menstrual cycle phase that had the greatest impact on physical activity, they equally
432 recognised the value of physical activity when coping with menstrual symptoms. It
433 became apparent that their perspectives were informed by an understanding of the
434 effects that physical activity had on physical and mental health. For instance, Val, Lisa,
435 and Elaine explained:

436 > I think exercise has been a big help with my mental health. Even going for a walk.
437 > I'll consciously do it because it makes me feel better. I feel lazy and more bloated
438 > if I don't move much. (Val, Non-avoider)

> I think it's good for your longer term health. I know that people say exercise helps with your periods. (Lisa, Avoider)

> I think to begin with I was quite emotional because I wasn't active. With being more consistently physically active, my mood swings are not bad at all. (Elaine, Non-avoider)

Not only did the participants recognise the benefits of physical activity, but they also sought to undertake it in everyday life. These women reported continuous physical activity throughout the menstrual cycle and, in their recollections, demonstrated an instilled sense of commitment. As an example, Olivia (Non-avoider) described why she pushed herself to exercise:

> I force myself to do things. I'm very active, so I tend to stay physically active. I thank myself afterwards. It makes things better, especially the cramping and sluggishness. All I want to do is tuck up in a ball on my bed. So forcing myself to go to the gym is worth it because I do feel so much better after.

Sharing a perception of the period as something that should not limit activities of everyday life, some of the participants felt as though they had no reason to skip the gym. As a former professional dancer, Ava expected herself to commit to physical activity even on days of the period. Throughout her career as a professional dancer, she had developed a strong sense of commitment to routine training, which she had transferred into her approaches to physical activity (Stephan, 2003). Holding high expectations of herself, Ava (Non-avoider) differentiated the period from health problems or injuries and explained:

> There's no injury or pain that's preventing me from going. I just feel unwell. I'd rather not go when I'm too tired or something is wrong with me. I think, "Okay well at least you went and maybe don't go another time." There's no actual physical reason for me not to go. It's a subjective feeling.

Likewise, Nina (Non-avoider) described that she sought continuity in her routines:

> I usually have a day at the start of my period, when I'm a bit off. If I planned a session, I would do it and leave it behind me. I'm keen to follow my routines because I don't think that my periods are strong enough. There is no need for me to change things. I'm always challenging my brain whether I need to change something or whether I can try it.

It is noteworthy that the above-presented data extracts stem from interviews with women, who described their menstrual symptoms as manageable and therefore did not feel the need to avoid physical activity. Many participants, however, did describe avoidance of behaviours; either of physical activity environments (e.g., the gym) or of exercises (e.g., abdominal work) and types of exercise (e.g., cardiovascular training). The majority of conversations in this context therefore focused on the adaptations made to maintain some level of physical activity. None of the participants scheduled avoidance of physical activity due to menstrual events. Rather, symptoms had to be managed *in situ* and often left the participants feel unable to follow their "normal" physical activity routines. As an example, Willow (Non-avoider) changed her workouts to avoid the frustration she associated with not being able to perform the way she would on days when she did not have the period. She explained:

> On my period, I don't feel like my workouts are as productive. I will swap what I do. I tend to focus more on upper body to avoid the annoyance I have if I have a bad session and I'd probably stay away from cardio.

For Hannah (Avoider), the first day of the period usually meant avoiding physical activity completely:

> Sometimes I get home from work on the first day and think, "Forget it, not this week", and just stay at home. Then on later days, when I do decide to go for a run

> or do exercise, I wouldn't put as much effort in. I'd choose an easier class rather than a more intense one.

For Scarlett and Harper, the discomfort of using sanitary products led them to alter routines:

> I do a lot of running and I don't really do that when I'm on my period. The sensation feels weird, so I stick to weight bearing exercises. The feeling's not there as much when I do that. I don't wear tampons because I find them uncomfortable, so I wear sanitary towels and I always wonder, "Oh have they moved?" … it's about where the pad is and it can get sore. It doesn't stop me but instead of doing half an hour, I might only do ten minutes of cardio. Or I'd sit on a bike instead of running because it's not moving as much. (Scarlett, Non-avoider)

> I'd go to the gym, but perhaps not do cardio. Because of my injured knee, I can't run and sitting on a bike with a pad or tampon is really uncomfortable. That would ruin my gym session. So, sessions don't last as long. I probably do more upper body than lower body. I don't think I do abs when I'm on my period. Especially crunches or sit-ups when you've got a pad on. It's not nice at all. (Harper, Avoider)

Symptoms, self, and social – Factors shaping physical activity

Interview participants recalled a variety of factors affecting the ways in which they managed physical activity throughout the menstrual cycle. Their suggestions broadly related to the symptoms associated with the period, to perceptions of self, and to social expectations.

The most prominent influence on women's physical activity routines was the perceived severity of menstrual symptoms. Although the types of symptoms, their duration, and occurrence varied, they commonly included abdominal cramps, headaches

and backaches, leg pains, lethargy and fatigue. The following data extracts are examples of the symptoms described by interview participants:

> I suffer most with sciatica-type leg pain. I'm extremely lethargic to the point where it's almost debilitating. Migraines as well, feeling dizzy and muggy. (Piper, Avoider)

> Normally I'm an energetic person, but when it's that time I'm tired. I can be moody, but it's mainly tiredness. I don't feel I have my normal amount of energy. (Hannah, Avoider)

> My body changes completely. When I put on a pair of trousers that are normally loose, they're tighter. My stomach feels heavy. And the fatigue! (Mary, Avoider)

> There were a couple of times, where I woke up in the morning and planned to go for a run, but then the cramps were so bad that I couldn't get out of bed. (Olivia, Non-avoider)

In addition to feeling physically unwell, many participants also spoke of a heightened sense of self-consciousness. The period affected how women thought about themselves and how they felt in their own skin. Interestingly, these perceptions were not only limited to those who avoided (certain aspects of) physical activity, but were also shared by those who made efforts to maintain activity levels throughout the menstrual cycle. As an example, Harper (Avoider), described:

> You're not your usual self. You just feel you're on the period. For me it's at the start, but at that point, it's always there that thought. Just like hyper aware of it.

For Val and Caroline, feelings of consciousness led them to carefully select clothes worn in physical activity environments. The participants recalled, respectively:

> I'm really conscious if I wear shorts or if my leggings are see through or thinking whether I've leaked. I'm more aware of what I do and how that might look. (Val, Non-avoider)
>
> I suppose with netball, I am conscious of what to wear because of the small shorts and dresses that we have to wear. I always wear a tampon over a towel and underwear that keeps everything in check. I actually saw a girl at netball a couple of years ago. You could see her pad through the shorts and I felt bad for her but nobody said anything. (Caroline, Non-avoider)

Beyond the sense of self-awareness, the perceived expectations others might have about menstrual events, shaped women's physical activity routines. Interview participants commonly referred to worries of being "found out" by others, recalled an awkwardness surrounding periods, and described subsequent discomfort in certain physical activity environments. For example, Lisa and Scarlett preferred to avoid the gym on days of heavier flow due to concerns over how others might react if they discovered the reasons for which they did not adhere to usual routines:

> The gym is a social place for me. I know a lot of people. They would know I wasn't on top form. My PT would say, "Why are you lifting this today?" I wouldn't wanna turn around, "I feel shit because of my period." I don't know how he would handle that, what his feelings would be. That's where I suppose that taboo comes in because I wouldn't go, "I'm taking it easy today because I'm on my period." Even though I say I talk about periods, I guess I don't because I'd rather avoid telling them that I was going easy because of my period. (Lisa, Avoider)

> In the first days when I'm heaviest, I feel embarrassed. I don't want other people to know. I'm scared that if I get out of the pool, blood is gonna run down my leg. I'm worried what other people would say. Especially with men in the gym. Someone might put me down and I wouldn't wanna go to the gym anymore. (Scarlett, Non-avoider)

Other participants perceived pressure to maintain their attendance at training sessions

and believed there were expectations for women to carry on "as normal" regardless of discomfort due to menstrual events. For Hannah and Harper, playing netball was not only important at a personal level, but also in a social context (Weiss, 2015). It was therefore to be continued throughout the menstrual cycle. The participants' perceptions of expectations and understandings that teammates and coaches might hold shaped their dedication to the sport (Weiss et al., 2010). They explained:

> With netball, you've got to go. There's no choice. In my netball team, if you don't train, you don't get played at the match. You've got that pressure. Also we pay for training and matches, so you don't want to waste money by not going. (Hannah, Avoider)

> When I played netball, I couldn't turn around to the team and say, "I can't play. I'm on my period." Someone might say, "I'm on my period too and I'm playing." Especially in a team of girls. You can't let them down when they all know how it feels. (Harper, Avoider)

Similarly, Mila and Nina believed that it was expected of women to disguise any signs of menstrual events. In Mila's (Non-avoider) words:

> When I'm on the period I don't want anyone to find out I'm not feeling hundred percent. Maybe I complain to a female co-worker or friend but I would never, even, if I called in sick, I wouldn't admit it's period-related. I would say I am not well. I think the expectation to carry on as usual is always there.

Nina (Non-avoider) explained:

> Nobody ever told me that I need to hide my tampon when I go to the loo at the gym, but I do it. Because I think, other people aren't as relaxed as me about periods. We don't talk about them. If we do, it's awkward.

Discussion

This mixed-methods study utilised an online questionnaire to quantify events relating to the menstrual cycle and physical activity as well as semi-structured interviews to explore women's lived experiences of physical activity throughout the menstrual cycle. The discussion draws together quantitative and qualitative results to provide rich interpretations of the questionnaire and interview data (O'Cathain, 2010).

In the present study, the majority of women who completed the questionnaire (84 of 128 women – Table 1) were categorised as non-avoiders of physical activity due to events of the menstrual cycle. Interview data revealed that the participants recognised the importance of physical activity and the benefits it brought to their lives. Through experiences in their upbringing, education, and employment, they had learned about the advantages of physical activity, which in turn affected their experiences of and commitment to physical activity throughout the menstrual cycle. Consistent with the knowledge that the present participants possessed, previous research has shown that connections existed between people's awareness of physical activity recommendations and their actual levels of physical activity (Plotnikoff et al., 2011). Those who knew about health recommendations tended to be more physically active in everyday life compared to those, who did not possess this level of understanding (Fredriksson et al., 2018). This was so especially when individuals knew not only about guidelines, but also about the health benefits associated with moderate physical activity (Heinrich et al., 2011). Interview data in the present study revealed that the participants had actually experienced positive post-workout effects on days of the period, for instance, uplifted emotional state, reduced pain, and increased feelings of accomplishment. This finding is in line with studies illustrating that exercise could alleviate menstrual symptoms (e.g., backaches – Chen & Hu, 2019) and enhance mental wellbeing throughout the menstrual

cycle (Kanojia et al., 2013). Physical activity has also been considered as a complementary treatment for dysmenorrhea (Samy et al., 2019) as it reduced the duration and severity of menstrual cramps (Dehnavi et al., 2018; Kannan et al., 2015).

In partial agreement with our hypothesis, one third of questionnaire respondents (44 of 128 participants) were categorised as avoiders of physical activity due to menstrual events (Table 1). This could be attributed to these avoiders having more severe menstrual symptoms, including longer periods, higher levels of pain and fatigue, and heavier flow as reflected in the questionnaire data. Despite the potential bias of menstrual recall (as discussed in detail in the methods) the qualitative data confirmed that women could not overlook menstrual events (e.g., bleeding and pain) and when considering whether to avoid physical activity, interviews revealed that the participants evaluated the severity of menstrual symptoms. For instance, symptoms that the women perceived as severe (e.g., migraines and abdominal pain) led the participants to avoid physical activity completely. This complete avoidance is comparable to recurrent school absence in adolescent women who suffered from dysmenorrhea (Houston et al., 2006). In adult women, missing university or workdays represented a common self-management strategy for painful periods (Chen et al., 2016). The present study participants confirmed that the period had to be managed (e.g., sanitary products) and taken into account in physical activity routines (e.g., types of exercises). The women in this research described the days of the period as limiting their ability to function as what they perceived “normal” for themselves. In particular, a combination of physical symptoms, lacking “energy” and motivation made it more challenging for the participants to perform physical activity as normal. These findings resonate with studies on the impact of the menstrual cycle on physical performance, such as through anaemia from heavy menstrual bleeding (Bruinvels et al., 2016), higher body temperature during

642 exercise in the luteal phase (De Jonge & Janse, 2003), and lower fatigue resistance in
643 the pre-menstrual phase (Ansdell et al., 2019).

644 The present study participants, however, did not necessarily avoid all forms of
645 physical activity on days of the period (a nuance not captured within the questionnaire).
646 Although the questionnaire data showed no significant relationship between physical
647 activity classification and avoidance, interviews were particularly useful to make sense
648 of this observation and to unpack the subtleties underpinning women's reports of
649 physical activity avoidance due to menstrual events without necessarily being less
650 physically active overall. Indeed, interviews uncovered aspects of physical activity
651 adaptation that have been previously unreported. Some of the participants, who reported
652 to avoid physical activity, did not avoid all forms of activity and instead, changed
653 exercise routines, used alternative physical activity or made up for missed physical
654 activity on days when they felt less affected by menstrual symptoms. Often, it was
655 about adapting routines depending on the perceived severity of menstrual symptoms and
656 levels of discomfort, consistent with previous work showing adaptations to activities of
657 daily life due to menstrual symptoms (Kennett et al., 2016). The selective avoidance
658 and modification of physical activity was routine to some participants and could reflect
659 women's knowledge about the benefits of physical activity to their health, physical
660 wellbeing, and mood (Fredriksson et al., 2018). Similar to women who selectively
661 avoided tasks in the workplace (e.g., meetings) due to reduced concentration, patience,
662 and efficiency (Brantelid et al., 2014), some of the present interview participants only
663 avoided physical activity that caused discomfort (e.g., lower body workouts), while
664 continuing more manageable activities (e.g., walking and upper body workouts), when
665 they believed that they could maintain some level of activity. This selective avoidance
666 of physical activity is comparable to reports of adaptation as a way to maintain physical

667 activity levels in other populations, such as pregnant women suffering from backaches
668 (Cioffi et al., 2010) as well as individuals suffering from chronic fatigue syndrome
669 (Larun & Malterud, 2011) and migraines (Buse et al., 2012).

670 Aside from the menstrual symptoms, our qualitative findings demonstrated how
671 self-perceptions and perceptions of social expectations influenced physical activity.
672 Interviews revealed that the participants had concerns about leakage of blood, product
673 use, and pain management in the presence of other people in physical activity
674 environments. Similar to women, whose commitment to exercise suffered from
675 heightened body consciousness in physical activity environments (Pridgeon & Grogan,
676 2012), several women in the present study described a heightened sense of self-
677 awareness on days of the period that led to careful selection of clothes and exercises.
678 Comparably, heightened consciousness in public spaces was previously described in
679 women, who felt their bodies did not conform to predefined norms of femininity, such
680 as female bodybuilders in the presence of casual gym visitors, in public (Shilling &
681 Bunsell, 2009), and when sharing photos of their physique on social media (Marshall et
682 al., 2019). In the present study, the perceptions of self in physical activity environments
683 were closely connected to concerns over what others might say if they found out about
684 women's menstrual events. Sensations, such as bleeding, pain, and fatigue, associated
685 with the period in particular, were to be "dealt with" in private. This persisted even
686 though the interview participants had reframed their own views of menstrual events and
687 felt comfortable to talk about them (Lee, 2002). The participants believed, however, that
688 upbringing and societal norms of the period in particular as something shameful and
689 embarrassing led women to silence and conceal (signs of) the period (e.g., blood and
690 sanitary product) (Chrisler et al., 2015; Spadaro et al., 2018). The concerns of women in
691 the present study about how others might react to signs of the period point towards

692 social stigma surrounding menstrual events that led women to avoid and adapt physical
693 activity (Johnston-Robledo & Chrisler, 2013; Kowalski & Chapple, 2000). Such stigma
694 surrounding exercise during the period has been similarly reported in overweight
695 individuals (Vartanian & Novak, 2011), people with mobility impairments (Mulligan et
696 al., 2017), and the LGBTQ+ community (Herrick & Duncan, 2018) undertaking
697 physical activity.

698 Due to the paucity of data on the impact of the menstrual cycle on physical
699 activity, in order to test our proposed hypothesis, it was necessary to construct the
700 components of the questionnaire from a number of different sources. These sources
701 have been acknowledged throughout the methods section including recall of menstrual
702 symptoms (Matteson et al., 2015), menstrual pain (Larroy, 2002), menstrual flow
703 heaviness (Fraser et al., 2015), avoidance (Fourquet et al., 2010), and physical activity
704 (Milton et al., 2011). Through adopting these previously validated components of the
705 questionnaire, we can state our main finding that physical activity avoiders have
706 heavier, longer, and more painful periods, despite the limitation that no assessment of
707 reliability or validity has been performed on the entirety of the questionnaire. It is
708 important to note however, that based on the nuanced responses from the interviews,
709 emphasising adaptation, over avoidance, future questionnaires on physical activity
710 within the menstrual cycle should be validated for both avoidance and adaptation.

711 In developing our questionnaire, our aim was to identify whether physical
712 activity avoidance could be attributed to menstrual symptoms. There are a wide range of
713 demographic co-variables that are unreported in the present study including education,
714 employment status, religious background, socio-economic level and ethnicity (e.g.,
715 Mondragon & Txertudi, 2019). As the area of physical activity avoidance due to
716 menstrual symptoms is underreported in general, our aim was to provide the first

overview of the impact of the menstrual cycle on physical activity. In future studies, the prevalence of physical activity avoidance may therefore be different to the present study, if presented based on some of these demographic groupings.

Our study demonstrated that binary measures of physical activity, such as those utilised in the present questionnaire, miss the nuances that underpin avoidance behaviours. The use of quantitative and qualitative methodology was therefore particularly useful to developing nuanced views of factors affecting physical activity, which included, but were not exclusive to, menstrual symptoms. Other important considerations that shaped women's physical activity related to perceptions of "self" and social expectations about menstrual events; two areas that need to be confronted in greater depth. Future research might therefore seek to employ qualitative methodology to understand women's self-presentations (e.g., Goffman, 1956) and the role of social stigma (e.g., Goffman, 1963) in physical activity environments. The participants in the present study understood the importance of physical activity to maintain a healthy lifestyle and they enjoyed being physically active. We acknowledge, however, that the limited sample size and volunteer nature of interview participation could be considered limitations of this study. Although comparable sample sizes were suggested in methodological texts (Onwuegbuzie & Collins, 2007) and mixed-methods research investigating the menstrual cycle (Moreno-Black & Vallianatos, 2005) and voluntary interviews were conducted to ensure ethical research practice (e.g., Hammersley & Traianou, 2012), we recognise that our decisions might have resulted in unreported differences between the present participants and those, who did not volunteer for interview participation. As with the limitations of the questionnaire outlined above, a worthwhile line of inquiry would therefore be to investigate how other demographic groups approach physical activity throughout the menstrual cycle. In particular, the

742 impact that the combination of menstrual symptoms, self-perceptions, and social norms
743 might have on physical activity warrants further research attention. In this context, it
744 would be of interest to explore women's familiarity with their own menstrual cycle and
745 to unpack their typical involvement in physical activity in order to understand how
746 differences among women in these areas might affect their management of physical
747 activity throughout the menstrual cycle.

748 In conclusion, the present study suggests that menstrual events are complex,
749 individual, and personal to the women experiencing them (e.g., Brantelid et al., 2014).
750 The results demonstrated that women did not simply avoid all physical activity. Rather,
751 they adapted physical activity depending on their distinct experiences of the menstrual
752 cycle. This insight into the multi-facetted effects that the menstrual cycle could have on
753 women's physical activity is pertinent to practitioners in the field. Creating safe spaces
754 for women who wish to speak about how their physical comfort, personal thoughts, and
755 perceptions of social norms might affect physical activity is important. Efforts in
756 academic and practitioner fields could contribute to normalising conversations about the
757 menstrual cycle (Johnston-Robledo & Chrisler, 2013; Kowalski & Chapple, 2000) and
758 support physical activity throughout the menstrual cycle in women of all ages and
759 abilities.

760

761 **References**

762 Ansdell, P., Brownstein, C. G., Škarabot, J., Hicks, K. M., Simoes, D. C. M., Thomas,
763 K., Howatson, G., Hunter, S. K. & Goodall, S. (2019). Menstrual cycle
764 associated modulations in neuromuscular function and fatigability of the knee
765 extensors in eumenorrheic females. *Journal of Applied Physiology, 126*, 1701-
766 1712. https://doi.org/10.1152/japplphysiol.01041.2018

Beitin, B. K. (2012). Interview and sampling: How many and whom. In J. F. Gubrium, J. A. Holstein, A. B. Marvasti, & K. D. McKinney (Eds.), *The SAGE handbook of interview research: The complexity of the craft* (2nd ed., pp. 243-254). SAGE Publications. https://doi.org/http://dx.doi.org.mmu.idm.oclc.org/10.4135/9781452218403.n17

Brantelid, I. E., Nilvér, H. & Alehagen, S. (2014). Menstruation during a lifespan: A qualitative study of women's experiences. *Health Care for Women International, 35*(6), 600-616. https://doi.org/10.1080/07399332.2013.868465

Braun, V., Clarke, V. & Weate, P. (2016). Using thematic analysis in sport and exercise research." In B. Smith & A. C. Sparkes (Eds.), *Routledge handbook of qualitative research in sport and exercise* (pp. 191-205). Routledge.

Brinkmann, S., & Kvale, S. (2018). *Doing interviews* (2nd ed.). SAGE Publications. https://dx.doi.org/10.4135/9781529716665

Brown, W. J., & Trost, S. G. (2003). Life transitions and changing physical activity patterns in young women. *American Journal of Preventive Medicine, 25*(2), 140-143. https://doi.org/10.1016/S0749-3797(03)00119-3

Bruinvels, G., Burden, R., Brown, N., Richards, T., & Pedlar, C. (2016). The prevalence and impact of heavy menstrual bleeding (menorrhagia) in elite and non-elite athletes. *PLoS One, 11*(2), e0149881. https://doi.org/10.1371/journal.pone.0149881

Bryman, A., Becker, S., & Sempik, J. (2008). Quality criteria for quantitative, qualitative and mixed methods research: A view from social policy. *International Journal of Social Research Methodology*, *11*(4), 261-276. https://doi.org/10.1080/13645570701401644

Buse, D., Manack, A., Serrano, D., Reed, M., Varon, S., Turkel, C., & Lipton, R. (2012). Headache impact of chronic and episodic migraine: Results from the American migraine prevalence and prevention study. *Headache: The Journal of Head and Face Pain, 52*(1), 3-17. https://doi.org/10.1111/j.1526-4610.2011.02046.x

Chen, C. X., Kwekkeboom, K. L., & Ward, S. E. (2016). Beliefs about dysmenorrhea and their relationship to self-management. *Research in Nursing & Health, 39*(4), 263-276. https://doi.org/10.1002/nur.21726

Chen, H.-M., & Hu, H.-M. (2019). Randomized trial of modified stretching exercise program for menstrual low back pain. *Western Journal of Nursing Research, 41*(2), 238-257. https://doi.org/10.1177/0193945918763817

Chrisler, J. C., Marván, M. L., Gorman, J. A., & Rossini, M. (2015). Body appreciation and attitudes toward menstruation. *Body Image, 12,* 78-81. https://doi.org/10.1016/j.bodyim.2014.10.003

Cioffi, J., Schmied, V., Dahlen, H., Mills, A., Thornton, C., Duff, M., Cummings, J., & Kolt, G. S. (2010). Physical activity in pregnancy: Women's perceptions, practices, and influencing Factors. *The Journal of Midwifery & Women's Health, 55*(5), 455-461. https://doi.org/10.1016/j.jmwh.2009.12.003

Collins, K. M. T. (2010). Advanced sampling designs in mixed research: Current practices and emerging trends in the social and behavioral sciences. In A. Tashakkori & C. Teddlie (Eds.), *SAGE handbook of mixed methods in social & behavioral research* (2nd ed., pp. 353-378). SAGE Publications. https://doi.org/https://dx-doi-org.mmu.idm.oclc.org/10.4135/9781506335193.n15

Creswell, J. W., Klassen, A. C., Plano Clark, V. L., & Clegg Smith, K. (2010). *Best practices for mixed methods research in the health sciences*. Office for behavioral and social sciences research (OBSSR).

Davidson, C. (2009). Transcription: Imperatives for qualitative research. *International Journal of Qualitative Methods, 8*(2), 35-52. https://doi.org/10.1177/160940690900800206

De Jonge, X., & Janse, A. (2003). Effects of the menstrual cycle on exercise performance. *Sports medicine, 33*(11), 833-851. https://doi.org/10.2165/00007256-200333110-00004

Dehnavi, Z. M., Farzaneh, J., & Kamali, Z. (2018). The effect of aerobic exercise on primary dysmenorrhea: A clinical trial study. *Journal of Education and Health Promotion, 7*(3), 1-8. https://doi.org/10.4103/jehp.jehp_79_17

Dempsey, L., Dowling, M., Larkin, P., & Murphy, K. (2016). Sensitive interviewing in qualitative research. *Research in Nursing & Health, 39*(6), 480-490. https://doi.org/10.1002/nur.21743

Field, A. (2013). *Discovering statistics using IBM SPSS statistics.* SAGE Publications.

831 Findlay, R. J., Macrae, E. H. R., Whyte, I. Y., Easton, C., & Forrest, L. J. (2020). How
832 the menstrual cycle and menstruation affect sporting performance: experiences
833 and perceptions of elite female rugby players. *British Journal of Sports*
834 *Medicine*, *0*, 1-7. https://doi.org/10.1136/bjsports-2019-101486
835 Fourquet, J., Gao, X., Zavala, D., Orengo, J. C., Abac, S., Ruiz, A., Laboy, J., & Flores,
836 I. (2010). Patients' report on how endometriosis affects health, work, and daily
837 life. *Fertility and Sterility, 93*(7), 2424-2428.
838 https://doi.org/10.1016/j.fertnstert.2009.09.017
839 Fraser, I. S., Critchley, H. O., Broder, M., & Munro, M. G. (2011). The FIGO
840 recommendations on terminologies and definitions for normal and abnormal
841 uterine bleeding. *Seminars in Reproductive Medicine*, *29*(5), 383-
842 390. https://doi.org/10.1055/s-0031-1287662
843 Fraser, I. S., Mansour, D., Breymann, C., Hoffman, C., Mezzacasa, A., & Petraglia, F.
844 (2015). Prevalence of heavy menstrual bleeding and experiences of affected
845 women in a European patient survey. *International Journal of Gynecology &*
846 *Obstetrics, 128*(3), 196-200. https://doi.org/10.1016/j.ijgo.2014.09.027
847 Fredriksson, S. V., Alley, S. J., Rebar, A. L., Hayman, M., Vandelanotte, C., &
848 Schoeppe, S. (2018). How are different levels of knowledge about physical
849 activity associated with physical activity behaviour in Australian adults? *PloS*
850 *One, 13*(11), e0207003. https://doi.org/10.1371/journal.pone.0207003
851 Garcia-Perez, M. A., & Nunez-Anton, V. (2003). Cellwise residual analysis in two-way
852 contingency tables. *Educational and Psychological Measurement, 63*(5), 825-
853 839. https://doi.org/10.1177/0013164403251280
854 Goffman, E. (1956). *The presentation of self in everyday life*. Penguin.
855 Goffman, E. (1963). *Stigma: Notes on a spoiled identity*. Simon and Schuster, Inc.
856 Hammersley, M., & Traianou, A. (2012). *Ethics in qualitative research: Controversies*
857 *and contexts*. SAGE Publications. https://doi.org/10.4135/9781473957619
858 Heinrich, K. M., Maddock, J., & Bauman, A. (2011). Exploring the relationship
859 between physical activity knowledge, health outcomes expectancies, and
860 behavior. *Journal of Physical Activity and Health, 8*(3), 404-409.
861 https://doi.org/10.1123/jpah.8.3.404

Herrick, S. S., & Duncan, L. R. (2018). A qualitative exploration of LGBTQ+ and intersecting identities within physical activity contexts. *Journal of Sport and Exercise Psychology, 40*(6), 325-335. https://doi.org/10.1123/jsep.2018-0090

Houston, A. M., Abraham, A., Huang, Z., & D'Angelo, L. J. (2006). Knowledge, attitudes, and consequences of menstrual health in urban adolescent females. *Journal of Pediatric and Adolescent Gynecology, 19*(4), 271-275. https://doi.org/10.1016/j.jpag.2006.05.002

Ivankova, N. V. (2014). Implementing quality criteria in designing and conducting a sequential QUAN → QUAL mixed methods study of student engagement with learning applied research methods online. *Journal of Mixed Methods Research*, *8*(1), 25-51. https://doi.org/10.1177/1558689813487945

Johnston-Robledo, I., & Chrisler, J. C. (2013). The menstrual mark: Menstruation as social stigma. *Sex Roles, 68*(1), 9-18. https://doi.org/10.1007/s11199-011-0052-z

Kannan, P., Chapple, C. M., Miller, D., Claydon, L. S., & Baxter, G. D. (2015). Menstrual pain and quality of life in women with primary dysmenorrhea: Rationale, design, and interventions of a randomized controlled trial of effects of a treadmill-based exercise intervention. *Contemporary Clinical Trials, 42*, 81-89. https://doi.org/10.1016/j.cct.2015.03.010

Kanojia, S., Sharma, V. K., Gandhi, A., Kapoor, R., Kukreja, A., & Subramanian, S. K. (2013). Effect of yoga on autonomic functions and psychological status during both phases of menstrual cycle in young healthy females. *Journal of Clinical and Diagnostic Research: JCDR, 7*(10), 2133-2139. https://doi.org./10.7860/JCDR/2013/6912.3451

Kennett, D. J., O'Hagan, F. T., & Meyerhoff, T. J. (2016). Managing menstruation: Moderating role of symptom severity on active coping and acceptance. *Western Journal of Nursing Research, 38*(5), 553-571. https://doi.org/10.1177/0193945915620055

Kowalski, R. M., & Chapple, T. (2000). The social stigma of menstruation: Fact or fiction? *Psychology of Women Quarterly, 24*(1), 74-80. https://doi.org/10.1111/j.1471-6402.2000.tb01023.x

Kural, M., Noor, N. N., Pandit, D., Joshi, T., & Patil, A. (2015). Menstrual characteristics and prevalence of dysmenorrhea in college going girls. *Journal of*

Family Medicine and Primary Care, 4(3), 426-431. https://doi.org/10.4103/2249-4863.161345

Larroy, C. (2002). Comparing visual-analog and numeric scales for assessing menstrual pain. *Behavioral Medicine, 27*(4), 179-181. https://doi.org/10.1080/08964280209596043

Larun, L., & Malterud, K. (2011). Finding the right balance of physical activity: a focus group study about experiences among patients with chronic fatigue syndrome. *Patient Education and Counseling, 83*(2), 222-226. https://doi.org/10.1016/j.pec.2010.05.027

Lee, S. (2002). Health and sickness: The meaning of menstruation and premenstrual syndrome in women's lives. *Sex Roles, 46*(1), 25-35. https://doi.org/10.1023/A:1016033517659

Lee, P. H., Macfarlane, D. J., Lam, T. H., & Stewart, S. M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 1-11. https://doi.org/https://doi.org/10.1186/1479-5868-8-115

Markland, D. (2009). The mediating role of behavioural regulations in the relationship between perceived body size discrepancies and physical activity among adult women. *Hellenic Journal of Psychology, 6*(2), 169-182.

Marshall, K., Chamberlain, K., & Hodgetts, D. (2019). Female bodybuilders on Instagram: Negotiating an empowered femininity. *Feminism & Psychology, 29*(1), 96-119. https://doi.org/10.1177/0959353518808319

Marván, L., & Molina-Abolnik, M. (2012). Mexican adolescents' experience of menarche and attitudes toward menstruation: Role of communication between mothers and daughters. *Journal of Pediatric and Adolescent Gynecology, 25*(6), 358-363. https://doi.org/10.1016/j.jpag.2012.05.003

Marván, L., Ramírez-Esparza, D., Cortés-Iniestra, S., & Chrisler, J. C. (2006). Development of a new scale to measure beliefs about and attitudes toward menstruation (BATM): Data from Mexico and the United States. *Health Care for Women International, 27*(5), 453-473. https://doi.org/10.1080/07399330600629658

Matteson, K. A., Scott, D. M., Raker, C. A., & Clark, M. A. (2015). The menstrual bleeding questionnaire: Development and validation of a comprehensive patient

- reported outcome instrument for heavy menstrual bleeding. *BJOG: An International Journal of Obstetrics & Gynaecology*, *122*(5), 681-689. https://doi.org/10.1111/1471-0528.13273

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica: Biochemia Medica, 23*(2), 143-149. https://doi.org/10.11613/BM.2013.018

Miller, T. (2017). Telling the difficult things: Creating spaces for disclosure, rapport and 'collusion' in qualitative interviews. *Women's Studies International Forum, 61*, 81-86. https://doi.org/10.1016/j.wsif.2016.07.005

Milton, K., Bull, F.C., & Bauman, A., (2011). Reliability and validity testing of a single-item physical activity measure. *British Journal of Sports Medicine*, *45*(3), 203-208.

Milton, K., Clemes, S., & Bull, F. (2013). Can a single question provide an accurate measure of physical activity? *British Journal of Sports Medicine, 47*(1), 44-48.

Mondragon, N. I., & Txertudi, M. B., 2019. Understanding menstruation: Influence of gender and ideological factors. A study of young people's social representations. *Feminism & Psychology*, *29*(3), 357-373. https://doi.org/10.1177/0959353519836445

Moreno-Black, G., & Vallianatos, H. (2005). Young women's experiences of menstruation and athletics. *Women's Studies Quarterly, 33*(1/2), 50-67.

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, *1*(1), 48-76. http://dx.doi.org/10.1136/bjsports-2011-090899

Mulligan, H., Miyahara, M., & Nichols-Dunsmuir, A. (2017). Multiple perspectives on accessibility to physical activity for people with long-term mobility impairment. *Scandinavian Journal of Disability Research, 19*(4), 295-306. https://doi.org/10.1080/15017419.2016.1167772

NHS Digital. (2017). Health survey for England 2016 – Physical activity in adults. https://files.digital.nhs.uk/publication/m/3/hse16-adult-phy-act.pdf

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods, 16*(1), 1-13. https://doi.org/10.1177/1609406917733847

O'Cathain, A. (2010). Mixed methods involving qualitative research. In I. Bourgeault, R. Dingwall, & R. De Vries (Eds.), *The SAGE handbook of qualitative methods in health research* (pp. 575-588). SAGE Publications. https://dx.doi.org/10.4135/9781446268247

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, *12*(2), 281-316.

Plotnikoff, R. C., Lippke, S., Johnson, S. T., Hugo, K., Rodgers, W., & Spence, J. C. (2011). Awareness of Canada's physical activity guide to healthy active living in a large community sample. *American Journal of Health Promotion, 25*(5), 294-297. https://doi.org/10.4278/ajhp.090211-ARB-60

Pridgeon, L., & Grogan, S. (2012). Understanding exercise adherence and dropout: An interpretative phenomenological analysis of men and women's accounts of gym attendance and non-attendance. *Qualitative Research in Sport, Exercise and Health, 4*(3), 382-399. https://doi.org/10.1080/2159676X.2012.712984

Samy, A., Zaki, S. S., Metwally, A. A., Mahmoud, D. S. E., Elzahaby, I. M., Amin, A. H., Eissa, A. I., Abbas, A. M., Hussein, A. H., & Talaat, B. (2019). The effect of zumba exercise on reducing menstrual pain in young women with primary dysmenorrhea: A randomized controlled trial. *Journal of Pediatric and Adolescent Gynecology, 32*(5), 541-545. https://doi.org/10.1016/j.jpag.2019.06.001

Sandelowski, M. (2000). Combining quantitative and qualitative sampling, data collection, and analysis techniques in mixed-method studies. *Research in Nursing and Health*, *23*(3), 246-255.

Santer, M., Wyke, S., & Warner, P. (2007). What aspects of periods are most bothersome for women reporting heavy menstrual bleeding? Community survey and qualitative study. *BMC Women's Health, 7*(1), 8-13. https://doi.org/10.1186/1472-6874-7-8

Santer, M., Wyke, S., & Warner, P. (2008). Women's management of menstrual symptoms: Findings from a postal survey and qualitative interviews. *Social Science & Medicine, 66*(2), 276-288. https://doi.org/10.1016/j.socscimed.2007.08.018

Schechtman, K. B., Barzilai, B., Rost, K., & Fisher, E. B. (1991). Measuring physical activity within a single question. *American Journal of Public Health, 81*(6), 771-773. https://doi.org/10.2105/AJPH.81.6.771

Schoep, M. E., Nieboer, T. E., Van der Zanden, M., Braat, D. D. M., & Nap, A. W. (2019). The impact of menstrual symptoms on everyday life: A survey among 42,879 women. *Gynecology, 220*(6), 561-567. https://doi.org/10.1016/j.ajog.2019.02.048

Scott, M., Flaherty, D., & Currall, J. (2013). Statistics: Dealing with categorical data. *Journal of Small Animal Practice*, *54*(1), 3-8. https://doi.org/10.1111/j.1748-5827.2012.01298.x

Shilling, C., & Bunsell, T. (2009). The female bodybuilder as a gender outlaw. *Qualitative Research in Sport and Exercise, 1*(2), 141-159. https://doi.org/10.1080/19398440902909009

Small, C. M., Manatunga, A. K., & Marcus, M. (2007). Validity of self-reported menstrual cycle length. *Annals of Epidemiology*, *17*(3), 163-170. https://doi.org/10.1016/j.annepidem.2006.05.005

Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology, 11*(1), 101-121. https://doi.org/10.1080/1750984X.2017.1317357

Smith, B., & Sparkes, A. (2016). Introduction - An invitation to qualitative research. In B. Smith & A. Sparkes (Eds.), *The Routledge handbook of qualitative research in sport, exercise and health* (pp. 1-8). Routledge.

Spadaro, G., d'Elia, S. R. G., & Mosso, C. O. (2018). Menstrual knowledge and taboo TV commercials: Effects on self-objectification among Italian and Swedish women. *Sex Roles, 78*(9-10), 685-696. https://doi.org/10.1007/s11199-017-0825-0

Stephan, Y. (2003). Repercussions of transition out of elite sport on subjective well-being: A one-year study. *Journal of Applied Sport Psychology*, *15*(4), 354-371. https://doi.org/10.1080/714044202

Stubbs, M. L. (2008). Cultural perceptions and practices around menarche and adolescent menstruation in the United States. *Annals of the New York Academy of Sciences, 1135*(1), 58-66. https://doi.org/10.1196/annals.1429.008

Tashakkori, A., & Teddlie, C. (2008). Quality of inferences in mixed methods research: Calling for an integrative framework. In M. M. Bergman (Ed.), *Advances in mixed methods research: Theories and application* (pp. 101-119). SAGE Publications. https://dx.doi.org/10.4135/9780857024329

Vartanian, L. R., & Novak, S. A. (2011). Internalized societal attitudes moderate the impact of weight stigma on avoidance of exercise. *Obesity, 19*(4), 757-762. https://doi.org/10.1038/oby.2010.234

Warren, C. A. B. (2012). Interviewing as social interaction. In J. F. Gubrium, J. A. Holstein, A. B. Marvasti, & K. D. McKinney (Eds.), *The SAGE handbook of interview research: The complexity of the craft* (2nd ed., pp. 129-142). SAGE Publications. https://dx.doi.org/10.4135/9781452218403

Wegienka, G., & Baird, D. D. (2005). A comparison of recalled date of last menstrual period with prospectively recorded dates. *Journal of Women's Health*, *14*(3), 248-252. https://doi.org/https://doi.org/10.1089/jwh.2005.14.248

Weiss, W. M. (2015). Competitive-level differences on sport commitment among high school and collegiate-level athletes. *International Journal of Sport and Exercise Psychology*, *13*(3), 286-303. https://doi.org/10.1080/1612197X.2014.958517

Weiss, W. M., Weiss, M. R., & Amorose, A. J. (2010). Sport commitment among competitive female athletes: Test of an expanded model. *Journal of Sports Sciences*, *28*(4), 423-434. https://doi.org/10.1080/02640410903536442

Zamani Sani, S. H., Fathirezaie, Z., Brand, S., Pühse, U., Holsboer-Trachsler, E., Gerber, M., & Talepasand, S. (2016). Physical activity and self-esteem: Testing direct and indirect relationships associated with psychological and physical mechanisms. *Neuropsychiatric Disease and Treatment, 12*, 2617-2625. https://doi.org/10.2147/NDT.S116811

1050 **Tables**

1051 Table 1. Mean (SD) participant characteristics and menstrual cycle symptoms taken
1052 from the questionnaire.

	All	**Avoider**	**Non-avoider**
N	128	44	84
Age (yrs)	27.9 (7.5)	28.2 (8.0)	27.2 (7.3)
Height (m)	1.65 (0.06)	1.65 (0.06)	1.65 (0.06)
Body mass (kg)	63.2 (12.2)	61.9 (12.8)	63.8 (11.8)
Length of period (days)	4.64 (1.80)	5.07 (1.11)*	4.42 (2.04)
Bleeding (days/MC)	3.81 (2.10)	4.43 (2.07)*	3.49 (2.05)
Spotting (days/MC)	1.51 (1.80)	2.02 (2.37)	1.24 (1.35)
Fatigue (days/MC)	2.82 (2.99)	4.43 (3.45)†	3.45 (2.34)
Pain (days/MC)	2.60 (2.87)	4.20 (3.60)†	1.76 (1.95)
Pain severity (numerical scale)	3.95 (2.80)	5.27 (2.41)†	3.25 (2.75)

1053 MC, menstrual cycle. *denotes significant difference from non-avoider (p<0.05),
1054 †denotes significant difference from non-avoider (p<0.01).

1055

Figures

Figure 1. Overview of study design (adapted from Ivankova, 2014)