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2 **Physical activity avoidance during menstruation- the role of coping and self-efficacy.**

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Abstract

The aim of the present study was to investigate self-efficacy and coping strategies in women who avoided physical activity during menstruation (avoiders), adapted their physical activity during menstruation (adaptors) or maintained their normal physical activity during menstruation (non-avoiders).

Using an online survey which included sections on menstrual severity, menstrual attitude (menstrual self-evaluation questionnaire), coping (the pre-menstrual coping measure, and the coping inventory for stressful situations) and self-efficacy for exercise, 349 respondents were classified as: avoiders (40.7%), adapters (33.5%), and non-avoiders (25.8%).

Avoiders and adapters had similar menstrual symptoms, with menstrual flow and menstrual pain being greater in avoiders than non-avoiders ($p<0.001$). The positive elements of menstrual attitude were lower in avoiders compared to non-avoiders ($p<0.05$). Avoiders had lower task-focussed coping strategies ($p<0.05$), with pre-menstrual coping showing avoiders to have higher self-care and adjusting energy coping strategies (all $p<0.01$). Compared to non-avoiders and adapters, avoiders had lower self-efficacy for exercise ($p<0.001$).

During menstruation avoiders of physical activity do so with more severe and frequent menstrual symptoms, a less positive attitude to menstruation, more passive and avoidance coping strategies and with lower self-efficacy than non-avoiders. Despite presenting with similar menstrual symptoms to avoiders, adapters continue to exercise during menstruation, underpinned by a higher self-efficacy for exercise. Taken together, these findings suggest that self-efficacy and coping strategies may act as important factors for physical activity avoidance during menstruation.

Physical activity avoidance during menstruation- the role of coping and self-efficacy.

Introduction

The burden of menstrual symptoms, cramps, fatigue, bleeding, and pain, has been shown to prevent women from participating in daily activities (Schoep et al., 2019). Forty-three percent of adolescent women avoid aspects of daily life due to menstrual bleeding and pain (Houston et al., 2006) and 64% miss an average of 2.6 workdays per month due to severe menstrual bleeding and pain (Fourquet et al., 2010). Further, menstrual symptom severity (Kolić et al., 2021), frequency (Bruinvels et al., 2021) and stigma (Kolić et al., 2022) have been linked to physical activity avoidance during menstruation in 34-69% of physically active women (Bruinvels et al., 2016; Kolić et al., 2021). Through mixed methods investigation, Kolić et al. (2021), identified that adaptation of exercise routines, intensity and modalities led some physically active women, termed adaptors, to continue to undertake physical activity during menstruation. These finding are not constrained to amateur performers as elite athletes also report a negative performance impact of period cramps and heavy menstrual bleeding on their training session completion (Findlay et al., 2020). It should be noted however, elite athletes report a lower prevalence of menstruation induced training avoidance at 25% (Armour et al., 2020), compared to the 34-69% from recreationally active women (Bruinvels et al., 2016; Kolić et al., 2021). Beyond menstrual symptom severity, no previous work has examined the role of coping style and self-efficacy in the context of avoiding and adaptive behaviour and menstruation when undertaking physical activity, despite the important role that these variables play in motivating active behaviours (Bray, 2007).

At an elite level, athletes report various coping behaviours for menstrual symptoms through pain management strategies, hormone contraception use, activity avoidance, and the use of multiple menstrual products (Brown et al., 2021; Findlay et al., 2020); these findings are consistent with non-elite physically active participants (Kolić et al., 2021; Kolić et al., 2022). Physical activity level has previously been associated with differences in stress related coping, and those with lower levels of physical activity have lower task focused coping styles and a more passive and avoidant style

(Wijndaele et al., 2007). In contrast to those with low physical activity, more physically active women have a more positive, task focused approach to coping with adverse situations (Wijndaele et al., 2007). Self-efficacy beliefs have been shown to be a strong predictor for initiating and maintaining physical activity (Bauman et al., 2012) and, after experiencing initial success in an activity, self-efficacy beliefs are likely to increase, help to maintain, and resume health behaviours, even when confronted with challenges (Bandura et al., 1999). We have previously identified menstruation as a challenge to undertaking physical activity (Kolić et al., 2021; Kolić et al., 2022), and we propose here that self-efficacy for exercise may play a role in determining whether women avoid physical activity during their periods, adapt their behaviour, or make no or limited adjustments. Further, for women less experienced with physical activity, their periods may present a factor for which they have not yet developed appropriate task specific coping strategies. To date, there is no reported research on non-task/task specific coping styles, menstrual symptoms, and self-efficacy within the context of physical exercise. Our aim, therefore, was to explore whether coping strategy behaviours and self-efficacy are moderating variables in how women manage the impact of menstruation on physical activity.

Materials & Methods

Ethical approval for the study was obtained from the faculty University Ethics Committee (Ethos approval-2022-45166-36454) and the research was carried out in accordance with the declaration of Helsinki. Participants were recruited through the research team's institutional social media and women's sporting organisations between March and June 2023. Voluntary links to the survey were made available where participants provided their informed consent via a compulsory drop down selection along with all participant information. 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. Consenting participants completed a questionnaire about their menstrual symptoms, exercise avoidance, self-reported physical activity status, coping strategies and self-efficacy. All aspects of the questionnaire were completed online (Qualtrics, London, UK). All questions required a compulsory answer. All

questions were developed using previously adopted or externally validated questionnaires. The study was conducted following the Checklist for Reporting Results of Internet ESurveys (CHERRIES) guidelines (Eysenbach, 2004). Participation rate (based on the available data) was 100% with all participants who provided consent completing all questions within the survey. Multiple responses by participants was considered unlikely as all IP addresses from respondents were unique.

Participant demographics

Participants completed drop-down selections for age, height, body mass and ethnicity. Options were given for height in metres and feet and inches, and for body mass in kg and lbs. Ethnicity options were provided consistent with the UK census classification for ethnic group, with a write in option for 'other' (see Table 1).

Physical activity and athletic status

Self-reported physical activity status was assessed based on the following criteria: (i) sedentary (walking less than 20 mins a day); (ii) slightly active (walk over 20 mins per day); (iii) moderately active (undertake at least 20 mins of moderate physical activity per day); (iv) very active (undertake 40 mins of moderate intensity physical activity per day); and (v) athlete (high intensity exercise 5+ days a week). For subsequent analysis, as there were fewer than five participants within the sedentary category and nine participants in the athlete category, the groups were condensed with their closest categories. The physical activity classifications were therefore: sedentary-to-low activity, moderately active, and very active-to-athlete. Despite retrospective recall having known limitations for quantifying daily physical activity accurately (Lee et al., 2011), a single item physical activity question has been shown to be a valid approach for the purposes of participant classification (Milton et al., 2013), with high test-retest reliability (r = 0.82, Milton et al. 2011) and was, therefore, adopted in the present study.

Athlete status (Athlete/Non-athlete) was determined by participants selecting either "I compete regularly in athletic competitions for an organised sports team" or "I would consider myself an elite

athlete" where elite is defined as an individual who: (i) derives a living from competing in a sport; (ii) is a senior representative nominated by a relevant sporting body; (iii) is a member of the senior training squad for a relevant sporting body; or (iv) is aged 16 or above and in an elite development pathway, as defined previously (Williams et al., 2017).

Physical activity avoidance

Participants were classified based on whether they had previously avoided physical activity, exercise training or sport during their period. Participants who selected only "I have not altered my training because of my period" were classified as non-avoiders, those who selected "I have postponed or avoided training due to my period" within their response were classified as avoiders, and those who selected "I have altered the type of training because of my period" and/or "I have lowered the intensity of my training because of my period" were classified as adapters; participants could select multiple responses or provide a single response. If the avoidance strategy was listed amongst their responses they were classified as avoiders, non-avoiders provided the single response of "I have not altered my training because of my period", whereas adapters provided responses excluding avoidance, but with one of the adaptation strategies in their responses. This classification approach draws on our original work in physical activity avoidance, but includes the adaptation category to cover the breadth of strategies participants identified for coping with/concealing menstruation during the period (Kolić et al., 2021; Kolić et al., 2022).

Hormonal contraceptive use

Participants were given seven options related to their use of hormonal contraceptives, 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, and consistent with our previous research (Kolić et al., 2021), participants were classified as: (i) None: if they used no form of hormonal contraceptive; (ii) Pill: if they used any form of oral contraceptive; and (iii) Non-oral contraceptive: if they used any form of indwelling, injected or

cutaneous hormonal contraceptive. For consistency throughout, we have not distinguished between a hormonal pill withdrawal bleed and menstruation, and refer throughout this paper to menstrual symptoms and menstruation (or the period) as encompassing both.

Menstrual characteristics

Participants were asked "Over the last three months, roughly how many days, on average, has your period lasted?". These data are reported in the results as "length of period". This approach is discussed within our previous published work (Kolić et al., 2021).

Menstrual pain

Participants were provided with a numerical Likert-type 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 the section 'more info'.

Heavy or normal menstrual bleeding

Participants were classified as heavy menstrual bleeders based on the selection of two or more of the following symptoms and consistent with Fraser et al. (2015): (i) a need for double sanitary products (e.g., tampons and towels) at the same time; (ii) a need for frequent changes of sanitary towels or tampons (every two hours or less, or 12 sanitary items per day); (iii) bleeding through sanitary products onto clothes or bedding; or (iv) 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).

Pregnancy

Participants were asked "In the last 12 months have you been pregnant or given birth?". Individuals who answered 'Yes' were excluded from all analysis.

Menstrual Symptom Index

The menstrual symptom index (MSI) is an 18 item, 4 choice Likert scale (the 18 items are listed in figure 1a). Participants were asked to identify how frequently they experienced 18 menstrual or pre-menstrual symptoms. Symptom frequency was selected as "often" (scored 3) to "never" (scored 0) with a possible range of 0–54, where 54 would correspond to all 18 symptoms each occurring often (Bruinvels et al., 2021). In addition to the MSI, menstrual symptom number, the number of symptoms experienced during menstruation was also recorded consistent with previous (Bruinvels et al., 2021). Menstrual symptom impact was also calculated based on the MSI using a Likert-type scale similar to other validated scales (Uebersax et al., 1995). Participants were asked to identify menstrual symptoms that had had a negative impact on their ability to undertake sporting competition, training or exercise, choosing at least 3 of the 18 MSI symptoms, with three additional symptoms of "bleeding through clothes", "menstrual product discomfort" and "menstrual products being visible" being drawn from themes of previous work on exercise avoidance during the period (Brown et al., 2021; Findlay et al., 2020; Kolić et al., 2021; Kolić et al., 2022).

Menstrual Self Evaluation Questionnaire

The menstrual self-evaluation questionnaire (MSEQ) assess women's feelings about their own menstruation, rather than menstruation in general (Roberts, 2004). The MSEQ is a 16 item, 7 choice Likert-type scale with responses ranging from strongly agree to strongly disagree. The first 11 items

are split to determine whether the participants consider menstruation as bothersome, disgusting, or shameful, with the subsequent items to establish whether the participants consider menstruation as enabling awareness of one's own body or life affirming. Items were scored and summed to identify a higher score as a more positive attitude to one's own menstruation (α = .82, (Grose & Grabe, 2014).

Coping

The Pre Menstrual Coping Measure (PMCM) contains 32 items, with a 5 choice Likert scale (Read et al., 2014). The PMCM has five subscales representing five premenstrual coping processes with high levels of reliability (mean α=0.79) and validity with other coping measures across the subscales (Read et al., 2014). The subscales are: Avoiding Harm: Items 1 – 8, Awareness and Acceptance of Premenstrual Change: Items 9 – 18, Adjusting Energy: Items 19 – 23, Self-Care: Items 24-27 and Communicating: Items 28 – 32. Items are scored as: Doesn't apply to me (0), Seldom applies to me (1), Sometimes applies to me (2), Applies to me (3), and Almost always applies to me (4).

The Coping Inventory for Stressful Situations (CISS) includes 21 items, with a 5 choice Likert scale (Cosway et al., 2000) where the participants rate the extent to which they engage in various types of coping activities ranging from "Not at All" (scored 1) to "Very Much" (scored 5). The 21-items are sub-classified into avoidance, emotion, or task-orientated strategies. The CISS has high reliability (α=0.81) and construct validity across the subscales in women (Cohan et al., 2006).

Self-efficacy for Exercise

Self-efficacy was assessed through the self-efficacy for exercise (SEE) scale, a 9 item, 11 point Likert-type scale with high internal reliability (α=0.92) and construct validity (Resnick & Jenkins, 2000). Participants were asked "How confident are you right now that you could exercise if:" with nine statements to select including: "the weather was bothering you", "you felt tired", "you were too busy with other activities". Participants could select 0-10 where 0 was marked "not confident" to 10, marked "very confident". A higher score denotes higher self-efficacy for exercise. Although not

specifically developed for active young adults, the SEE has been reported to sufficiently generalisable to the present population (Gyurcsik et al., 2004)

Statistics

All quantitative analyses were performed using IBM SPSS Statistics 24 software. Where parametric assumptions of normal distribution were not met (Shapiro-Wilk's test, $p<0.05$), group comparisons were made using Kruskal Wallis tests. Non-parametric outcomes are reported as mean (SD), with group differences reported as: H and *p*. Nominal level data were assessed using Chi-square associations for classifications of pain, flow, contraception, and physical activity. Participants were grouped as avoiders, adapters, or non-avoiders, with subsequent post-hoc analysis performed if Chi-square reached significance ($p<0.05$). As there were three classification groups for physical activity avoidance category, cell-wise residual analysis was performed for Chi-square *post-hoc* with the level of significance adjusted for the three levels (Garcia-Perez & Nunez-Anton, 2003). For the nominal level variables, a significant outcome of Chi square is described as a significant relationship rather than a group difference based on previous recommendations (McHugh, 2013). The datasets generated during the current study are available in the e-space repository, https://e-space.mmu.ac.uk/633475/ reference number 00633475.

Results

Avoidance

From the 349 respondents, 40.7% were classified as avoiders, having avoided exercise during their periods, 33.5% were classified as adapters, having altered their training type or intensity during their period, and 25.8% were classified as non-avoiders having made no adjustments to their physical activity during their period (see Table 2).

Menstrual symptoms

The most frequent menstrual symptoms (see Figure 1a) experienced by all participants was tiredness and fatigue followed by menstrual cramps; these were also identified as the most impactful menstrual symptoms for physical activity avoidance (see Figure 1b). Avoiders and Adapters had significantly higher menstrual pain [H (2, n = 349) = 24.2, p <0.001, Table 2], more frequent presentation of menstrual symptoms [MSI, H (2, n = 349) = 31.4, p <0.001, Table 2] and more menstrual symptoms [MSI number, H (2, n = 349) = 29.1, p <0.001, Table 2] than non-avoiders. There was a significant association between menstrual flow and avoidance (X^2 (2, N = 349) =10.8, p= 0.005, table 3), with 56.3% of avoiders classified as having heavy flow, compared to 34.4% of non-avoiders (p=0.015). Similarly, 43.7% of avoiders were classified as having normal flow compared to 65.6% of non-avoiders (p=0.020). However, this did not reach significant difference at the adjusted α level (p<0.017). Contraceptive use did not differ between participant groups (X^2 (4, N = 349) =3.622, p= 0.460. See Table 3).

There was a significant association between athlete status and physical activity avoidance (X^2 (2, N = 349) =6.447, p=0.04. See Table 3), with non-athlete prevalence being 75% of avoiders, 60% of non-avoiders and 66% of adapters. Self-reported physical activity level was significantly associated with physical activity avoidance (X^2 (2, N = 349) = 36.51, p<0.001. See Table 3), 23% of avoiders were classified as undertaking high physical activity (p<0.001), in contrast to 41% of adapters and 36% of non-avoiders. The classification of low physical activity did not reach significance in post-hoc analysis, whereas moderate physical activity was higher in the avoiders compared to the other groups (p<0.001. See Table 3).

Menstrual Attitude

The enabling domain of the menstrual self-evaluation questionnaire was lower in avoiders compared to non-avoiders [H (2, n = 349) = 6.86, p = 0.032. See Table 2] and lower for the life-affirming domain in avoiders compared to non-avoiders and adapters [H (2, n = 349) = 9.54, p=0.008. See Table 2].

Coping Strategy

There was no difference between participant groups for Avoidance or Emotional coping. Task coping was significantly lower in avoiders compared to non-avoiders [H (2, n = 349) = 9.35, p =0.009. See Table 2]. Avoidance, awareness, and communication coping were not different between participant groups. Adjusting energy was higher in avoiders and adapters compared to non-avoiders, and higher in avoiders compared to adapters [H (2, n = 349) = 45.1, p<0.001. See Table 2]. Self-care was higher in avoiders compared to non-avoiders [H (2, n = 349) = 12.1, p=0.002. See Table 2].

Adaptation Strategy

The most adopted strategy to manage menstrual symptoms during the period was clothing alteration followed by pain medication (see Table 4). Strategies for mitigating physical activity during the period differed between avoidance classification. Clothing alteration was significantly associated with physical activity avoidance (X^2 (2, N = 349) = 16.22, p<0.001. See Table 4), being significantly lower in the non-avoiders (p<0.001). Pain medication use was also associated with physical activity avoidance category (X^2 (2, N = 349) = 7.374, p=0.025. See Table 4), being significantly lower in the non-avoiders (p=0.023). Not adopting any strategies was also associated with physical activity classification (X^2 (2, N = 349) = 15.749, p<0.001. See Table 4), being significantly higher in the non-avoiders (p<0.001). Contraceptive pill use, for controlling menstrual symptoms, was associated with avoidance category (X^2 (2, N = 349) = 6.443, p=0.04. See Table 4) but failed to reach significance for any group under *post-hoc* correction.

Self-efficacy for Exercise

Avoiders had significantly lower self-efficacy for exercise than non-avoiders and adapters [H (2, n = 349) = 15.01, p = 0.001, Table 2]. There was no difference between adapters and non-avoiders for self-efficacy.

Discussion

The main findings show a high prevalence of physical activity avoidance during menstruation (41%), consistent with 34% observed previously (Armour et al., 2020; Kolić et al., 2021). In the present findings, and in previous, contrasting to non-avoiders, avoiders have higher menstrual pain (Kolić et al., 2021), more menstrual symptoms (Bruinvels et al., 2021), are more likely to have higher menstrual flow (Bruinvels et al., 2016) and a lower level of physical activity (Kolić et al., 2021). The present data reveals, uniquely, that self-efficacy is lower in avoiders, who also have lower scores on the positive domains of menstrual attitude, with lower task coping strategies, but higher coping strategies for adjusting energy and self-care. We have also identified a novel group of adapters comprising 34% of participants, who despite having similarly high levels of menstrual pain, symptoms and menstrual bleeding as avoiders, had greater exercise self-efficacy and, importantly, continued to exercise during their period.

The period and menstrual symptoms can be considered to represent a physiological, psychological, and social barrier to physical activity. Further, greater frequency and intensity of menstrual symptoms can represents a physical barrier to participation for some women. In the present study fatigue, cramps and pain were identified as the most impactful symptoms to physical activity avoidance, a similar observation made to others (Adam et al., 2022; Findlay et al., 2020). In terms of psychological barriers, mood changes and anxiety (in the form of worry) were identified as the 3rd and most frequent menstrual symptom, similar to a previous large sample of physically active women (Bruinvels et al., 2021). Around 30% of the present participants identified mood changes and anxiety as being “most impactful” to physical activity avoidance. The role of pain and anxiety in physical activity avoidance has a precedent from a number of clinical conditions such as back pain and arthritis (Demmelmaier et al., 2018; Farris et al., 2019). Combined with social norms that reinforce concealment of menstrual symptoms, silencing of menstrual status, and awkwardness associated with menstruation in physical activity environments (Kolić et al., 2021; Kolić et al., 2022), there is growing evidence that menstruation may represent a significant barrier to physical activity for some women.

Beyond the presentation of more severe menstrual symptoms, there were differences between the avoiders and other groups in terms of their attitudes to their own menstruation and menstrual coping strategies. Avoiders, although not having higher negative menstrual attitudes, presented with lower positive emotions to their own periods and were less likely to describe their period as life-affirming or empowering, this was in contrast to the non-avoiders. This apparent lack of a reciprocal relation between positive and negative menstrual attitudes has been addressed previously, and was postulated to suggest that positive and negative attitudes toward menstruation operate differently and are, perhaps, not opposite ends of a continuum (Roberts, 2004). The lower positive attitudes to menstruation in avoiders could be proposed to be due to self-objectification and disruption of a women's connection to a positive experience with her period (Stubbs, 2008). In addition, for those with more severe menstrual symptoms the period may be framed less positively from past experiences (Nichols, 1995). It should be acknowledged that the reframing of menstrual experiences has been demonstrated to enable a more positive menstrual attitude in those with pre-menstrual syndrome (Morse, 1999).

Task orientated coping was lower in avoiders compared to non-avoiders, with no group differences in emotional or avoidance coping. To reach high competition, athletes are expected to use a repertoire of problem-focused coping to change, or manage actively, a demanding environment (Crocker & Graham, 1995) and perceived controllability of the situation is linked with problem-focused coping and low perceived control with emotion-focused and avoidance coping (Anshel & Kaissidis, 1997). Task-oriented coping is a similar concept to problem-focused coping and involves attempts to alter the relationship between the person and the environment (Lazarus & Folkman, 1984). Individuals who generally take an active problem solving approach to stressful situations have a predominantly task-oriented style (Endler & Parker, 1990). Participants with lower levels of physical activity have previously been shown to demonstrate the least active coping behaviour, instead displaying a passive and avoidant coping style (Wijndaele et al., 2007). It could therefore be reasonably speculated that experience and competence, combined with the present observation of a more positive attitude to

their menstruation, allows non-avoiders to focus on completing the task of physical activity performance, whilst avoiders are likely to struggle to continue their normal physical activity levels during menstruation. In the present study, this was reflected in the pre-menstrual coping measure showing a higher adjusting energy domain for the avoiders, consistent with those participants adjusting their daily routines in response to their menstrual symptoms. Similarly, the higher score for self-care within the avoiders, would be consistent with those avoiders with more severe menstrual symptoms being more likely to avoid physical activity.

The present study identified adapters as those who, despite high levels of menstrual pain and menstrual symptoms, continue to undertake physical activity through modification of their activity routines, underpinned by a higher level of self-efficacy when compared to physical activity avoiding counterparts. Bandura and Walters (1977) theorized that individuals with higher levels of self-efficacy, perceive obstacles, in this case, menstruation, not as barriers, but as challenges. Bandura (1991) also noted that individuals who underestimate their abilities (i.e., having low self-efficacy) tend to avoid activities because of impaired thought patterns and stress reactions, creating internal barriers to physical activity participation. This may result in avoidance of challenging situations (Bandura et al., 1999), such as attending school during menstruation (Houston et al., 2006), or avoiding physical activity altogether in favour of other coping strategies (as seen in the avoiders' behaviour in the present study). Similarly, with a more task orientated coping strategy, it is likely task mastery of their chosen physical activity contributes to the higher-self efficacy in the present adapters and non-avoiders (Stutts, 2002). This suggests that self-efficacy could act as a mechanism for maintenance of physical activity during the period, and a potential target for behavioural interventions. Indeed, self-efficacy beliefs rank among the strongest predictors for initiating and maintaining physical activity (Bauman et al., 2012) and, upon experiencing initial success in an activity, self-efficacy beliefs are likely to increase, help maintain, and resume health behaviours, even in the face of challenges (Bandura et al., 1999). Therefore, it is possible that those with high self-efficacy and prior experience navigating physical activity during the period are likely to maintain that behaviour in the future.

The task specific self-efficacy assessed through the self-efficacy of exercise scale, has been described as a "proximal determinant of vigorous physical activity" whilst coping "may play a role in determining task self-efficacy beliefs" (p.139) (Gyurcsik et al., 2004). The role of more task-orientated coping, combined with higher levels of experience and participation may inform the higher self-efficacy of the non-avoiders and adapters in the present study. It has been postulated that equipping participants with coping skills may specifically increase coping self-efficacy and, thus, encourage the performance of physical activity (Bandura et al., 1999). What is apparent from the present research is that a more positive attitude towards menstruation, a more task orientated coping strategy and greater self-efficacy are adopted by those with more severe menstrual symptoms to maintain physical activity during menstruation. As such, behavioural interventions to target physical activity self-efficacy alongside coping effectiveness in the context of menstruation may be useful to minimise the risk of potentially deleterious health effects of physical activity avoidance during menstruation.

The implications from the present research would suggest that physical activity avoidance during menstruation may be a modifiable behaviour, through interventions to target coping styles and self-efficacy. Behavioural approaches propose that much behaviour is goal-oriented and people self-regulate their behaviour to achieve personal goals, through a feedback loop that involves: (i) setting goals; (ii) identifying discrepancies between goals and current status based on feedback; and (iii) making plans to reduce these discrepancies (Carver & Scheier, 2012). As such, techniques associated with goal setting, action planning, and self-regulation (e.g., Rational Emotive Behaviour Therapies), may help to promote self-efficacy and behaviour change. Evidence has demonstrated that techniques that promote the largest increases in physical activity self-efficacy and actual physical activity include action planning, where people are promoted to form detailed plans of when, in which situation and/or where to act (Williams & French, 2011) and self-monitoring of behaviour, which includes intention formation, receiving feedback on performance, specific goal setting, and review of behavioural goals (Michie et al., 2009). The implications of our findings suggest that future interventions for increasing physical activity during menstruation should consider self-efficacy for physical activity as a behavioural

target. This study represents a starting point for the development of educational and behaviour change programmes tailored to the specific physical, psychological, and behavioural needs of those who avoid exercise during menstruation, such as those that have been implemented to address schools absenteeism (Long et al., 2022), and more broadly around developing more task focussed coping strategies to overcome menstruation as a barrier to physical activity (Williams & French, 2011). The present study represents one of the largest participant groups surveyed in the topic of menstruation and physical activity and, although short of the numbers completing the physical activity and menstrual symptom frequency review through a commercial fitness tracking app (Bruinvels et al., 2021), we have adopted an in depth, robust and validated set of questionnaires to investigate some of the mitigating factors around physical activity avoidance during menstruation. As a result, we have uniquely identified adaptors as those who continue to maintain physical activity despite high levels of symptoms associated with menstruation.

We acknowledge that, within the 349 participants completing the present survey, 88% were classed as 'white', and there are reported differences in attitudes and approaches to coping with menstruation as a result of religion, culture and ethnicity (Bhartiya, 2013). Around 21 of 25 European countries show lower sporting participation in women, with as many as a third fewer women participating in sport in the UK (Van Tuyckom et al., 2010). This sex disparity is higher amongst Muslim women in European countries (Strandbu et al., 2020), with the WHO identifying the Eastern Mediterranean region (incorporating the Middle East and many Islamic nations) as having 44% of women under 45 not meeting physical activity guidelines compared to ~20% of Eastern Mediterranean men, and ~25% of similarly aged women from the European region (WHO, 2022). Based on our sample size, we are unable to desegregate outcomes by ethnicity, religion, or culture, and acknowledge that our findings are presented within the constraints of the population sampled.

Conclusion

The present research has identified that during menstruation avoiders of physical activity do so in the presence of more severe and frequent menstrual symptoms, a less positive attitude to menstruation, more passive and avoidance coping strategies and with lower self-efficacy than non-avoiders. Despite presenting with similar menstrual symptoms to avoiders, adapters continue to exercise during their periods, underpinned by a higher self-efficacy for exercise. Based on previous intervention strategies that have been adopted around self-efficacy, coping and physical activity it seems prudent to now acknowledge menstruation as a potentially modifiable barrier to be overcome for increasing physical activity within women.

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553

554 **Tables**

555 **Table 1** Participant demographics

Ethnicity	n	%
Asian (other)	7	2.0%
Asian British	13	3.7%
Black British	3	0.9%
Caribbean or African	4	1.1%
Mixed or multiple ethnic groups	13	3.7%
Other ethnic group	2	0.6%
White (other)	49	14.0%
White British	258	73.9%

556

557 **Table 2** Participant outcomes for menstrual symptoms, coping and self-efficacy measures.

	All	Avoider	Adapter	Non-avoider	H	P
N (%)	349	142 (40.7%)	117 (33.5%)	90 (25.8%)		
Age (yrs)	29.2 (8)	29.2 (7.8)	29.2 (8.2)	29.2 (8.2)	0.066	0.968
Height (cm)	167 (7)	166 (7)	167 (7)	166 (8)	1.045	0.593
Body mass (Kg)	67.1 (12.3)	67.9 (12.2)	65.9 (10.9)	67.3 (13.9)	1.773	0.412
Menstrual pain	5.17 (2.59)	5.68 (2.57)*	5.44 (2.4)*	4.03 (2.56)	24.15	0.000
MSI Score	34 (10.5)	36.9 (9.3)*	34.4 (10.1)*	29 (11.1)	31.439	0.000
MSI symptom number	14.8 (3.3)	15.6 (2.7)*	15.1 (3)*	13.2 (3.9)	29.134	0.000
CISS Avoidance	19.9 (5.5)	20.5 (5.4)	19.8 (4.8)	18.8 (6.4)	4.282	0.118
CISS Task	19.0 (8.0)	17.8 (7.9)*	18.8 (8)	21.1 (7.8)	9.347	0.009
CISS Emotional	20.0 (7.0)	20.3 (7.2)	20.2 (6.6)	19.2 (7.4)	1.275	0.528
MSEQ_Bothersome	16.8 (4.3)	16.6 (4.4)	16.9 (4.2)	17 (4.4)	0.98	0.613

MSEQ_Disgusting	26.8 (7)	25.9 (6.9)	27.2 (6.7)	27.8 (7.4)	5.116	0.077
MSEQ_Enabling	11.5 (4.6)	10.8 (4.4)*	11.9 (4.9)	12.2 (4.6)	6.858	0.032
MSEQ_Life affirming	8.64 (2.87)	8.15 (2.8)*†	8.96 (3.04)	9.00 (2.68)	9.541	0.008
PMCM Avoidance	12.3 (7.9)	13.1 (7.9)	12.7 (7.8)	10.7 (7.7)	5.061	0.080
PMCM Awareness	29.9 (6.4)	29.8 (6.5)	29.6 (5.7)	30.6 (7)	3.004	0.223
PMCM Adjust energy	10 (4.7)	11.8 (4.4)*†	9.7 (4.2)*	7.5 (4.7)	45.104	0.000
PMCM Self care	8.53 (4.38)	9.42 (4.11)*	8.38 (4.45)	7.32 (4.45)	12.051	0.002
PMCM Communication	8.41 (5.08)	8.73 (5.38)	8.25 (4.66)	8.12 (5.15)	0.713	0.700
Self-efficacy for exercise	47.6 (19.2)	42.7 (18.1)*†	50.7 (19)	51.4 (19.7)	15.012	0.001

Outcomes measures are provided with their associated domains. MSI, Menstrual symptom index. CISS, Coping Inventory for stressful situation. MSEQ, Menstrual self-evaluation questionnaire. PMCM, Pre-menstrual coping measure. *Denotes significant difference from Non-avoiders, † denotes significant difference from adapters (P<0.05).

Table 3 Population outcome distribution for physical activity classification, athlete status, hormonal contraceptive use and menstrual flow classification.

		Avoider	**Adapter**	**Non-avoider**
Physical activity	Low	54.2%	29.2%	16.7%
	Moderate	54.7%*	27.2%	18.5%
	High	22.7%*	41.3%	36.4%
Athlete status	Non-athlete†	45.0%	32.4%	22.7%
	Athlete	31.5%	36.0%	32.4%
Hormonal contraceptive use	Oral contraceptive user	50.0%	30.4%	19.6%
	Non-oral contraceptive user	36.7%	30.6%	32.7%
	Non-user	39.3%	34.8%	25.8%
Menstrual flow	Normal	33.5%	34.6%	31.9%
	Heavy	48.8%*	32.3%	18.9%

*denotes significance of Bonferroni corrected post-hoc comparisons. †denotes significance at population level with adjusted post-hoc not reaching significance.

Table 4 Menstrual adaptation strategies associated with physical activity during menstruation.

	All	Avoid	Adapter	Non-avoider
I alter my clothing	75.6%	80.3%	82.1%	60.0%*
I take pain medication for the pain	61.9%	66.9%	65.0%	50.0%*
I alter my menstrual products	31.8%	33.1%	35.0%	25.6%
I track my period to explain performance variations	24.6%†	22.5%	33.5%	16.7%
I do not adopt any strategies to control period symptoms or bleeding	15.8%	11.3%	11.1%	28.9%*
I take the pill to manage bleeding†	12.6%	16.9%	12.8%	5.6%
I discuss my symptoms with others	11.2%	12.7%	12.0%	7.8%

*denotes significance of Bonferroni corrected post-hoc comparisons. †denotes significance at population level with adjusted post-hoc not reaching significance.

Figure legends

Figure 1a) Menstrual symptom index identifying the frequency of pre-menstrual symptoms from lowest (top) to most frequent (bottom). **b)** Menstrual symptom impact identifying the most impactful menstrual symptoms related to physical activity avoidance from least impactful (top) to most impactful (bottom).