

Menstrual Health in Adolescents with Congenital Heart Disease

Aygün Arı D et al. Menstrual Health in CHD Adolescents

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ABSTRACT

Objectives: As life expectancy increases in patients with congenital heart disease (CHD), providing appropriate gynecological care has become more important. While the gynecologic and reproductive health concerns of adults with CHD are increasingly recognized, studies focusing on menstrual problems in adolescents with CHD are limited. This study aimed to evaluate menstrual characteristics and related symptoms in adolescents with CHD.

Methods: Adolescents aged 12–21 years who had experienced menarche at least two years earlier were included. The CHD group was classified as mild, moderate, or severe, and healthy adolescents served as controls. Menstrual histories were obtained from all participants. In the CHD group, additional clinical data (diagnosis, surgery/interventions, and medication use) were collected. Menstrual parameters were compared between the CHD and control groups, as well as across CHD subgroups.

Results: A total of 108 adolescents with CHD (41 mild, 42 moderate, 25 severe) and 76 healthy controls were enrolled. No significant differences were found between groups in terms of age at menarche, menstrual cycle length, period duration, or daily pad use ($p>0.05$). Dysmenorrhea severity and frequency were similar; however, school absenteeism due to dysmenorrhea was significantly higher in the control group ($p=0.037$). Physical premenstrual symptoms—particularly bloating, anxiety, and mood swings—were more frequent in controls ($p<0.05$). Menstrual education rates from healthcare professionals were low in both groups.

Conclusions: Our findings indicate that adolescents with CHD have menstrual characteristics comparable to those of healthy controls. However, despite these similarities, they may differ in their perception and tolerance of menstrual symptoms.

Keywords: congenital heart disease, menstrual dysfunction, premenstrual symptom, premenstrual syndrome

What is already known on this topic?

Females with congenital heart disease (CHD) may experience delayed menarche and higher rates of menstrual abnormalities, particularly in complex or cyanotic disease. Although reproductive health guidelines exist for adults with CHD, menstrual health in adolescents remains underexplored.

What this study adds?

Adolescents with CHD showed largely similar menstrual characteristics to healthy peers, despite subtle differences in pain and symptom perception. Antiplatelet/anticoagulant therapy tended to be associated with increased menstrual bleeding, highlighting the importance of individualized menstrual counseling in this population.

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Introduction

Congenital heart disease (CHD), the most common major congenital anomaly, is a growing global health concern. Its prevalence is increasing, having been reported as 9.4 per 1,000 live births between 2010 and 2017 (1). Advances in treatment have markedly improved survival, with over 97% of affected children now reaching adulthood, depending on the severity of the lesion (2, 3). As life expectancy rises, addressing broader health needs, including menstrual, sexual, and reproductive health, has become increasingly important (4). Studies have shown that females with CHD tend to experience menarche later than the general population, particularly those with complex or cyanotic heart disease (5–7). Furthermore, primary amenorrhea and menorrhagia have been reported more frequently in these patients (6, 8). While menstrual patterns in acyanotic patients appear similar to those of the general population, menstrual abnormalities are more commonly observed in patients who remain cyanotic until menarche (5).

In a study of 114 females aged 14–21 years, 83.3% reported at least one menstrual problem. While lesion complexity was not linked to problem frequency, those with more complex CHD were more likely to seek medical care (9).

Although guidelines exist for pregnancy and reproductive health in adults with CHD (10–12), gynecologic issues in adolescents remain underexplored (9). The American Heart Association advises obtaining a gynecological history after menarche and emphasizes age-appropriate counseling on sexual health, contraception, and pregnancy from early adolescence (13). Early identification of menstrual problems in this population is essential for timely intervention and appropriate counseling.

The aim of this study was to investigate menstrual problems specific to adolescents with CHD that may arise due to their underlying condition or related treatments.

Materials and methods

Participants

This observational, cross-sectional study enrolled 108 CHD patients presenting to a pediatric cardiology clinic over one year and 76 healthy adolescents attending routine visits at the same hospital. Participants were 12–21 years old and at least two years post-menarche. Patients with syndromic heart disease, chronic conditions, or medications affecting menstruation were excluded.

Data collection

The age, weight, height, and body mass index of all participants were recorded. A cardiac data form was completed for patients with CHD, and a menstrual data form was filled out for all participants. All procedures were conducted in accordance with the Declaration of Helsinki. Cardiac Data Form:

The CHD diagnosis of all patients was determined by a pediatric cardiologist. CHDs were classified as mild, moderate, or severe based on the severity of the defect, according to the European Society of Cardiology guidelines (12), and were also categorized as cyanotic or acyanotic based on the presence of cyanosis. Electronic medical records were reviewed for cyanosis status and duration, history of interventions or surgery (biventricular or univentricular), and use of anticoagulants, antiplatelets, or other CHD-related medications. When determining the duration of cyanosis, patients were considered cyanotic until the age at which they underwent corrective surgery.

Menstrual Data Form:

Menstrual history of the participants included age at menarche, menstrual cycle duration (days), menstrual bleeding duration (days), daily menstrual management product count, amount of bleeding during their period which patients classified as light, moderate, or heavy, and the presence of menstrual overflow. Light bleeding was defined as needing to change pads/tampons a few times a day, and they're rarely soaked. Moderate bleeding as needing to change pads/tampons every 3–4 hours, but they don't usually leak or overflow. Heavy bleeding as having to change pads/tampons every 1–2 hours because they get completely soaked or sometimes passing large clots or have leakage onto my clothes or bedding.

Oligomenorrhea was defined as cycles >45 days within 2–3 years after menarche, or >35 days beyond 3 years (14). Menstrual bleeding lasting 2–7 days was considered normal, and ≥8 days as prolonged (15).

Participants were asked about dysmenorrhea, its severity (1–10 scale), and any treatments received and their effectiveness. Additional questions addressed whether they had received professional information or care for menstrual problems, sexual activity, and contraceptive use. All participants received comprehensive sexual and menstrual counseling.

The presence of premenstrual symptoms was assessed. Physical symptoms questioned included joint or muscle ache, breast tenderness and pain, headache, a sensation of bloating or weight gain, gastrointestinal symptoms; emotional symptoms questioned included anger, anxiety, depressed mood, mood swings, suddenly feeling sad or tearful, crying, irritability, tension, sense of hopelessness; behavioral symptoms questioned included decreased interest in usual activities, feelings of lethargy, fatigue, or reduced energy, changes in appetite, either overeating or craving a specific food, changes in sleep pattern, either hypersomnia or insomnia, difficulty in concentrating, feeling overwhelmed or out of control (16).

Participants who met the diagnostic criteria were diagnosed with premenstrual syndrome or premenstrual dysphoric disorder based on self-reported retrospective history. Premenstrual syndrome was diagnosed by the presence of at least one physical, emotional, or behavioral symptom that occurred in the final week before the onset of menses, began to improve within a few days after the onset of menses, and became minimal or absent in the week following menses, in each of the three previous menstrual cycles. Premenstrual dysphoric disorder was diagnosed when five or more symptoms were present during the same timeframe. At least one of the symptoms must be emotional, and at least one must be a behavioral or physical symptom. The symptoms must cause clinically significant distress and should not be better explained by another psychiatric or medical disorder, or attributable to the physiological effects of a substance (17, 18).

Statistical analysis

Analyses were conducted using IBM SPSS Statistics, version 27.0 (IBM Corp.). Continuous variables were summarized as mean±standard deviation or median (Q1–Q3), and categorical variables as frequencies and percentages. Group comparisons were performed using Student's t-test or one-way ANOVA when parametric assumptions were met, and Mann–Whitney U or Kruskal–Wallis tests otherwise. Normality was assessed with the Shapiro–Wilk test. Categorical data were analyzed with the Pearson Chi-square test. Correlations were assessed using Spearman's rank correlation. A p value<0.05 was considered statistically significant.

Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the national research ethics guidelines of Turkey and with the Helsinki Declaration of 1975, as revised in 2008. This study was approved by the ethics committee of Hacettepe University with the protocol number of GO 21/1221. Written informed consent was obtained from all participants and their parents.

Results

A total of 108 patients with CHD (41 with mild defects, 42 with moderate defects and 25 with severe defects) and 76 healthy adolescents were included in the study. The mean age was 16.32±2.40 years in the CHD group and 16.14±2.61 years in the control group (p=0.630). There were no statistically significant differences in age, weight, height, and body mass index at admission between the CHD subgroups and the control group (Table 1).

There were no statistically significant differences between the CHD and control groups in terms of age at menarche, length or period or menstrual cycle, and number of menstrual products used per day (p>0.05 for all comparisons). When subgroups were compared, only the menstrual cycle duration was slightly longer in the moderate CHD group compared to the mild CHD group (p=0.013). There were no significant differences in the frequencies of oligomenorrhea and prolonged menstruation between the CHD and control groups (Table 1). Menstrual blood loss did not differ between CHD and control groups (p=0.237). Menstrual overflow was significantly more frequent in controls compared to the CHD group and subgroups (p=0.002, p=0.017). Details are shown in Table 1.

Of the 108 patients with CHD, 17 were using anticoagulants or antiplatelets. In the CHD group, patients using antiplatelet/anticoagulant therapy had a menstrual cycle length of 30 (30–31.5) days, a period duration of 7 (5–7.5) days, and used 4 (3–5.5) menstrual products per day; whereas in those not using such medication, these values were 30 (30–30), 6 (5–7), and 3 (2–4), respectively. No significant differences in menstrual cycle length (p=0.724), period length (p=0.146), or number of daily menstrual products (p=0.084) were found between CHD patients who were and weren't taking antiplatelet/anticoagulants. Prolonged menstruation was present in 4 patients (23.5%) who were using antiplatelet/anticoagulant medications, compared to 9 patients (9.9%) who were not using these medications (OR: 2.80; 95% CI: 0.75–10.44; Fisher's exact p=0.122). Among those using antiplatelet/anticoagulant therapy, bleeding was classified as heavy by 4 patients (23.5%) and light/moderate by 13 patients (76.5%). In those not using such therapy, 14 patients (15.4%) had heavy bleeding, while 77 patients (84.6%) had light/moderate bleeding (OR:1.69; 95% CI: 0.48–5.95; Fisher's exact p=0.478). Additionally, menstrual overflow occurred in 8 patients (47.1%) using antiplatelet/anticoagulants, compared to 26 patients (28.6%) in the non-user group (OR: 2.22; 95% CI: 0.77–6.39; p=0.132). In the CHD group, 88 patients (81.5%) reported dysmenorrhea and this number was 65 (85.5%) in the control group (p=0.470). When comparing the control group with the CHD subgroups, the frequency of dysmenorrhea was significantly lower in the moderate CHD group than in the other groups (p=0.043); however, there was no significant difference in dysmenorrhea scores between the groups (p=0.241). The rates of receiving treatment for dysmenorrhea and the types of medications used are presented in Table 1. Forty-five of the patients (90%) in the CHD group and 30 (96.8%) in the control group who used analgesics for dysmenorrhea had benefited from the treatment (p=0.258). Ten participants from each group reported using herbal tea for dysmenorrhea relief, with perceived benefit (p=0.589).

In the past year, 19 CHD patients (21.6%) and 24 controls (36.9%) reported school absenteeism due to dysmenorrhea ($p=0.037$), with no significant difference between CHD subgroups ($p=0.099$). Menstrual education was received by 11 CHD patients (10.2%) and 12 controls (15.8%) ($p=0.258$), and 21 CHD patients (19.4%) versus 21 controls (27.6%) consulted a healthcare professional for menstrual issues ($p=0.193$) (Table 1).

Only 1 participant in the control group was sexually active. There were no patients using contraception in the CHD and control groups. No significant differences were observed in the number of premenstrual symptoms between CHD and control groups ($p=0.089$) or among CHD subgroups ($p=0.128$) (Table 2). However, bloating, anxiety, and mood swings were more frequent in control group than CHD group ($p=0.013$, $p=0.022$, $p=0.020$), while other symptoms showed no significant difference. Additionally, premenstrual syndrome and premenstrual dysphoric disorder prevalence was comparable between groups ($p=0.304$, $p=0.940$) (Table 3).

When CHD patients were divided into two groups as cyanotic and acyanotic, there were 28 patients with cyanotic CHD and 80 patients with acyanotic CHD. Seven of the 61 patients who underwent surgery had univentricular physiology, while the remaining 54 had biventricular physiology. Among the patients with cyanotic CHD, 5 of them still had cyanosis. The mean duration of cyanosis was 1.66 ± 5.0 years. The mean age at menarche was 12.92 ± 1.16 years in patients who remained cyanotic until menarche ($n=6$), and 12.77 ± 1.46 years in those who were cyanotic at birth but underwent corrective surgery during childhood ($n=22$) ($p=0.826$). The menstrual cycle was significantly longer in the cyanotic CHD group compared to the acyanotic group ($p=0.034$); however, it remained within the normal range in all groups. The comparison of menstrual data based on cyanosis status is presented in Table 4. Spearman correlation analysis revealed no significant association between the duration of cyanosis and age at menarche ($\rho=0.162$, $p=0.410$, $n=28$), menstrual cycle length ($\rho=0.021$, $p=0.915$, $n=28$), menstrual period length ($\rho=0.181$, $p=0.357$, $n=28$), or the number of pads used per day ($\rho=-0.084$, $p=0.671$, $n=28$). Likewise, no significant correlations were found between cyanosis duration and the number of premenstrual symptoms ($\rho=-0.029$, $p=0.885$, $n=28$), physical ($\rho=-0.254$, $p=0.192$, $n=28$), emotional ($\rho=0.030$, $p=0.881$, $n=28$), or behavioral symptoms ($\rho=0.082$, $p=0.677$, $n=28$).

Discussion

This study aimed to evaluate menstrual characteristics and associated symptoms among adolescents with CHD compared to healthy peers. Contrary to our initial hypothesis, the findings revealed no significant differences between groups in terms of age at menarche, cycle length, duration of menstruation, or dysmenorrhea severity and frequency. These results suggest that the presence and severity of CHD may not substantially alter basic menstrual patterns in adolescents who have reached menarche.

One interpretation for these findings is that adolescents with CHD, particularly those with well-managed or surgically corrected lesions, may experience relatively stable overall health and endocrine function, mitigating potential menstrual disruptions. Moreover, consistent cardiology follow-up may promote better general health awareness and lifestyle regulation, which could buffer against menstrual irregularities. In a study of adolescents and adults with CHD, mean menarche age was 13 years in simple cases and 14.5 years in complex cases, both later than the general average of 12.8 years (8). Similarly, a study in adults showed that the average age at menarche was 12.5 years in the control group, whereas it was 13.1 years in women with acyanotic CHD, and 13.9 years in those who remained cyanotic until menarche (5). In a more comprehensive and recent study evaluating 1,593 patients, individuals with cyanotic and acyanotic CHD were compared without a control group. While the average age at menarche in the same population was reported as 13.15 years, it was found to be 13.3 years in patients with CHD and 13.5 years in those with cyanotic CHD, regardless of surgical status. This was attributed to an increased incidence of primary amenorrhea in the cyanotic CHD group. It was also noted that patients who remained cyanotic until menarche reached menarche at an age similar to those who were cyanotic at birth but had undergone surgical correction during childhood (6). In our study, although the mean age at menarche was higher in the cyanotic CHD group compared to the acyanotic CHD and control groups, this difference was not statistically significant. Additionally, there was no difference in age at menarche between those who remained cyanotic until menarche and those who were cyanotic at birth but underwent surgical correction. No correlation was found between duration of cyanosis and age at menarche. However, since our study included only adolescents who had experienced menarche at least two years prior, we were unable to capture data from those with delayed menarche or primary amenorrhea, which may partly explain discrepancies with findings from adult studies.

Although the difference was not statistically significant, oligomenorrhea was observed more frequently in the CHD group compared to the control group and was most common in the severe CHD group. A study evaluating adults with CHD without a control group reported that oligomenorrhea is common among women with CHD, although there is a lack of comparative data from the general population (6). It remains unclear whether these abnormal menstrual patterns represent a chronic anovulatory state, dysfunction of the hypothalamic-pituitary-ovarian axis, or disturbed uterine hemostasis secondary to chronic hypoxemia or erythrocytosis-induced hyperviscosity commonly seen in cyanotic CHD. Apart from the heart condition, multiple childhood surgeries may affect the body's normal processes that control the menstrual cycle (5, 7, 19).

The frequency of menstrual overflow was higher among controls compared to both the overall CHD group and its subgroups. However, given the subjective nature of this symptom—and the observation that some participants who reported normal menstrual product usage and low bleeding volume still described overflow—this difference was not considered clinically meaningful. The prevalence of prolonged menstruation was comparable between the CHD and control groups, though the highest rate was noted in the severe CHD subgroup, without reaching statistical significance. When CHD patients using anticoagulant/antiplatelet medications were compared to those not receiving such treatment, trends toward longer bleeding duration, greater daily menstrual product use, and increased rates of prolonged menstruation, heavy menstrual bleeding, and menstrual overflow were observed. However, none of these differences reached statistical significance. Given the relatively small number of patients receiving these medications, these findings should be interpreted with caution, as the study may have been underpowered to detect potential differences. A previous study involving both adolescents and adults with CHD similarly reported higher rates of menorrhagia in patients with complex lesions, but found no significant association with warfarin use (8). While our findings suggest a possible link between medication use and increased menstrual volume and duration, they remain inconclusive, and further research with larger cohorts is needed to clarify these associations.

Interestingly, physical premenstrual symptoms such as bloating, mood swings, and anxiety were more frequently reported in the control group. This unexpected pattern raises questions about symptom perception and reporting, which may differ in adolescents with chronic conditions (20). One possible explanation is that adolescents with CHD, who often experience more serious health concerns, may underreport or place less emphasis on menstrual discomfort relative to their peers. Alternatively, they may have developed higher symptom tolerance or different coping strategies over time. However, these interpretations remain speculative, as pain perception, coping mechanisms, and quality of life were not directly assessed in this study. In this context, to the best of our knowledge, while previous studies have focused on menstrual problems in adolescents with CHD and on reproductive and sexual health in adult patients, no studies have specifically evaluated premenstrual symptoms other than dysmenorrhea. Our findings therefore suggest that the frequency of premenstrual symptoms, premenstrual syndrome, and premenstrual dysphoric disorder in adolescents with CHD is comparable to that of healthy peers.

The frequency and severity scores of dysmenorrhea were similar between the CHD and control groups. Similarly, the rates of receiving treatment and response to treatment did not differ significantly. However, school absenteeism due to dysmenorrhea was higher in the control group which may further support our hypothesis concerning the potential underreporting or downplaying of menstrual symptoms by adolescents with CHD. It may also reflect differences in family or school-based support systems, individual pain thresholds, or prioritization of symptoms relative to overall health burdens. In a study evaluating menstrual problems in adolescents and young adults with CHD, dysmenorrhea was reported at a similar rate to that of the general population, consistent with our findings (9).

Despite these findings, the low rates of menstrual health education reported in both groups are concerning. This underscores the need for integrating reproductive health discussions into routine care, particularly for adolescents with chronic medical conditions like CHD, who may have unique risks or needs related to contraception, anticoagulation, or pregnancy counseling.

This study has several limitations. The cross-sectional design precludes causal inference, and symptom data relied on self-report, which may be influenced by recall or reporting bias. Premenstrual symptoms, PMS, and PMDD were assessed based on retrospective self-report rather than prospective daily symptom recording, as recommended by diagnostic guidelines; therefore, the findings may be subject to recall bias and should be interpreted with caution. Although prospective daily symptom tracking is considered the gold standard, its implementation in adolescent populations may be limited by adherence and feasibility challenges (21). The sample size, particularly in subgroup analyses by CHD severity and in patients receiving anticoagulant/antiplatelet therapy, was relatively small, limiting statistical power. As a result, some clinically meaningful differences, especially in bleeding-related outcomes, may not have been detected. Additionally, psychosocial factors influencing menstrual experiences were not comprehensively assessed. Nevertheless, we believe our study to be the first to evaluate premenstrual symptoms, premenstrual syndrome, and premenstrual dysphoric disorder in adolescents with CHD, which adds to its significance.

In conclusion, our study demonstrates that adolescents with CHD exhibit menstrual characteristics similar to those of their healthy peers, though their perception of pain and symptoms may differ. Although not statistically significant, we observed that as the disease becomes more complex (e.g., severe or cyanotic CHD), the age at menarche tends to be later, and the frequencies of oligomenorrhea and prolonged menstruation increase. Additionally, the use of antiplatelet or anticoagulant therapy appears to be associated with increased menstrual bleeding. Therefore, while each patient should be evaluated individually based on diagnosis, duration of cyanosis, and surgical history, we believe it is crucial that all CHD patients are educated on the characteristics of normal menstruation and on disease-specific risks, as this is an essential component of their overall care and follow-up.

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Conflicts of Interest

All authors declare that they have no actual or perceived conflicts of interest related to this work.

Author Contributions

DAA, MPK, IE, TK, OD, and SA contributed to the concept and design of the study. DAA, IE, AA, MEA, TK, OD, and SA were involved in data collection and processing. DAA, MPK, AA, MEA, and SA performed the analysis and interpretation of data. DAA and MEA conducted the literature search, DAA drafted the manuscript. All authors critically reviewed the manuscript and approved the final version.

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	Mild CHD ^a (N=41)	Moderate CHD ^b (N=42)	Severe CHD ^c (N=25)	CHD Total (N=108)	Control ^d (N=76)	Subgroups	Groups
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	p ₁	p ₂
Age	15.63±1.64	17.05±2.60	16.21±2.80	16.32±2.40	16.14±2.61	0.070	0.630
Weight	53.78±7.74	53.12±12.12	53.32±12.36	53.42±10.64	56.10±9.04	0.356	0.075
Height	161.22±6.68	158.90±6.12	160.36±8.58	160.12±6.97	162.10±5.88	0.083	0.044
BMI	20.78±3.38	20.96±4.13	20.64±3.88	20.82±3.77	21.33±3.33	0.792	0.342
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	p ₁	p ₂
Menarche age (years)	12.5 (11.75-13)	13 (12-13.5)	13 (11.75-13)	12.83 (12-13)	12.83 (12-13)	0.181	0.532
Length of menstrual cycle (days)	30 (28-30)	30 (30-33.5)	30 (30-31.5)	30 (30-30)	30 (28-30.75)	0.013^{a-b}	0.383
Period length (days)	7 (5-7)	6 (5-7)	6 (4.5-7)	6 (5-7)	6 (5-7)	0.686	0.760
Number of pads per day	3 (3-4)	3 (2-5)	3 (2-5)	3 (2-4)	3 (2-4)	0.941	0.737
Dysmenorrhea score	6 (4.5-8)	5 (0-7)	6 (4-8)	6 (3.25-8)	6 (3.25-8)	0.241	0.527
	N (%)	N (%)	N (%)	N (%)	N (%)	p ₁	p ₂
Amount of blood loss Light/moderate Heavy	33 (80.5%) 8 (19.5%)	35 (83.3%) 7 (16.7%)	22 (88%) 3 (12%)	90 (83.3%) 18 (16.7%)	58 (76.3%) 18 (23.7%)	0.582	0.237
Menstrual overflow No Rarely/Yes	28 (68.3%) 13 (31.7%)	27 (64.3%) 15 (35.7%)	19 (76%) 6 (24%)	74 (68.5%) 34 (31.5%)	35 (46.1%) 41 (53.9%)	0.017	0.002
Oligomenorrhea	1 (2.4%)	6 (14.3%)	5 (20%)	12 (11.1%)	5 (6.6%)		0.296
Prolonged menstruation	3 (7.3%)	6 (14.3%)	4 (16%)	13 (12.0%)	9 (11.8%)		0.968
Dysmenorrhea	37 (90.2%)	29 (69%)	22 (88%)	88 (81.5%)	65 (85.5%)	0.043*	0.470
Treatment for dysmenorrhea -No -Acetaminophen -NSAIDs	17 (45.9%) 13 (35.1%) 7 (18.9%)	12 (41.4%) 11 (37.9%) 6 (20.7%)	9 (40.9%) 10 (45.5%) 3 (13.6%)	38 (43.2%) 34 (38.6%) 16 (18.2%)	34 (52.3%) 16 (24.6%) 15 (23.1%)	0.645	0.187
School absenteeism	6 (16.2%)	9 (31%)	4 (18.2%)	19 (21.6%)	24 (36.9%)	0.099	0.037
Menstrual education	5 (12.2%)	5 (11.9%)	1 (4.0%)	11 (10.2%)	12 (15.8%)	0.490	0.258
Doctor visit for menstrual problems	7 (17.1%)	8 (19.0%)	6 (24.0%)	21 (19.4%)	21 (27.6%)	0.547	0.193

p₁ : comparison among mild CHD, moderate CHD, severe CHD, and control groups.
p₂ :comparison between CHD (total) and control groups.
*The frequency of dysmenorrhea in patients in the moderate CHD group was significantly lower than the others (p=0.043).
BMI: Body mass index, CHD: Congenital heart disease, IQR: Interquartile range, NSAIDs: Non-steroidal anti-inflammatory drugs, SD: Standart deviation

	Mild CHD (N=41)	Moderate CHD (N=42)	Severe CHD (N=25)	CHD Total (N=108)	Control (N=76)	Subgroups	Groups
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	p ₁	p ₂

Number of premenstrual symptoms	8 (4.5-10)	5.5 (2-10.25)	7 (2.5-11)	7 (3-10)	7.5 (4-11)	0.128	0.089
Number of physical symptoms	2 (1-3)	1 (0-3)	1 (0-2)	1 (0-2.75)	2 (1-3)	0.061	0.049
Number of emotional symptoms	2 (1-5)	3 (0-4.25)	3 (1-5.5)	3 (1-5)	3.5 (1.25-6)	0.197	0.057
Number of behavioral symptoms	3 (1-5)	2 (1-3.25)	2 (0-3.5)	2 (1-4)	2 (1-4)	0.107	0.603

p_1 : comparison among mild CHD, moderate CHD, severe CHD, and control groups.
 p_2 : comparison between CHD (total) and control groups.
 CHD: Congenital heart disease, IQR: Interquartile range

	Control (N=76)		CHD (N=108)		
	N (%)		N (%)		
	+	-	+	-	p
Physical Symptoms					
Abdominal pain	65(85.5%)	11(14.5%)	88(81.5%)	20(18.5%)	0.470
Joint/muscle ache	35(46.1%)	41(53.9%)	49(45.4%)	59(54.6%)	0.927
Breast tenderness	28(36.8%)	48(63.2%)	27(25%)	81(75%)	0.084
Breast pain	17(22.4%)	59(77.6%)	18(16.7%)	90(83.3%)	0.332
Headache	27(35.5%)	49(64.5%)	30(27.8%)	78(72.2%)	0.263
Bloating	33(43.4%)	43(56.6%)	28(25.9%)	80(74.1%)	0.013
GI symptoms	13(17.1%)	63(82.9%)	18(16.7%)	90(83.3%)	0.938
Emotional Symptoms					
Anger	48(63.2%)	28(36.8%)	61(56.5%)	47(43.5%)	0.364
Anxiety	27(35.5%)	49(64.5%)	22(20.4%)	86(79.6%)	0.022
Depressed mood	40(52.6%)	36(47.4%)	43(39.8%)	65(60.2%)	0.085
Mood swings	42(55.3%)	34(44.7%)	41(38%)	67(62%)	0.020
Crying	31(40.8%)	45(59.2%)	37(34.3%)	71(65.7%)	0.366
Irritability	27(35.5%)	49(64.5%)	36(33.3%)	72(66.7%)	0.758
Tension	40(52.6%)	36(47.4%)	55(50.9%)	53(49.1%)	0.820
Sense of hopelessness	20(26.3%)	56(73.7%)	23(21.3%)	85(78.7%)	0.428
Behavioral Symptoms					
Decreased interest in usual activities	20(26.3%)	56(73.7%)	34(31.5%)	74(68.5%)	0.449
Feelings of fatigue/lack of energy	48(63.2%)	28(36.8%)	61(56.5%)	47(43.5%)	0.364
Change in appetite	29(38.2%)	47(61.8%)	37(34.3%)	71(65.7%)	0.587
Food cravings	41(53.9%)	35(46.1%)	54(50%)	54(50%)	0.598
Sleep problems	18(23.7%)	58(76.3%)	31(28.7%)	77(71.3%)	0.448
Difficulty in concentrating	25(32.9%)	51(67.1%)	35(32.4%)	73(67.6%)	0.945
Feelings of being out of control	18(23.7%)	58(76.3%)	18(16.7%)	90(83.3%)	0.237
PMS	25(32.9%)	51(67.1%)	28(25.9%)	80(74.1%)	0.304
PMDD	8(10.5%)	68(89.5%)	11(10.2%)	97(89.8%)	0.940

CHD: Congenital heart disease, GI: Gastrointestinal, PMDD: Premenstrual dysphoric disorder, PMS: Premenstrual syndrome

Table 4. Comparison of menstrual data among cyanotic, acyanotic, and control groups				
	Cyanotic CHD^a	Acyanotic CHD^b	Control^c	
	Median (IQR)	Median (IQR)	Median (IQR)	p
Menarche age (years)	13 (12-13.38)	12.5 (12-13)	12.83 (12-13)	0.648
Length of menstrual cycle (days)	30 (30-38.75)	30 (28-30)	30 (28-30.75)	0.034^{a-b}
Period length (days)	6.5 (5-7)	6 (5-7)	6 (5-7)	0.949
Number of pads per day	3 (2-5)	3 (2-4)	3 (2-4)	0.820
CHD: Congenital heart disease, IQR: Interquartile range				