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Relationship between fear of COVID-19 and premenstrual syndrome in Turkish university students

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ABSTRACT

Premenstrual syndrome (PMS) has been reported to be related to psychological distress. The COVID-19 pandemic has globally caused heightened levels of stress, anxiety, and fear. There is no sufficient evidence regarding the impact of the fear of COVID-19 on PMS and related symptoms. Therefore, this study examined the association of the fear of COVID-19 with PMS among Turkish university students. The sample of this cross-sectional study consisted of 829 Turkish university students. Data were collected online using the Questionnaire Form, the Premenstrual Syndrome Scale (PMSS), and the Fear of COVID-19 Scale (FCoV-19S). The prevalence of PMS was 73 percent. The most common symptoms were fatigue, irritability, appetite changes, and depression. Participants had a moderate fear of COVID-19 (mean FCoV-19S: 20.48 ± 5.96). Most participants stated that the pandemic did not affect the menstrual cycle length (72.5 percent) and bleeding (79.6 percent). Participants who noted that the pandemic impacted the length of their menstrual cycles and bleeding had a significantly higher mean FCoV-19S score than those who did not (p = .000). Moreover, FCoV-19S scores were positively correlated with PMS scores, PMS-related discomfort, and dysmenorrhea VAS scores (p < .001). This study revealed that the fear of COVID-19 affected PMS and menstrual cycle-related symptoms in Turkish university students.

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COVID-19; fear; premenstrual syndrome; university students

Introduction

Premenstrual syndrome (PMS) is an important women's health problem. PMS is defined as "the presence of symptoms, such as irritability, anxiety, depression, edema, breast pain, and headaches up to five days before menstruation for at least three menstrual cycles in a row, with complete resolution within four days after the period starts" (The American College of Obstetricians and Gynecologists (ACOG) 2020). According to the Royal College of Obstetricians and Gynecologists (RCOG), four in ten women experience premenstrual symptoms, and almost one in ten is severely affected by PMS (Green et al. 2017). The global PMS prevalence is 47.8 percent (Direkvand-Moghadam et al. 2014). It is also quite common in Turkey, with a prevalence of 61.1 percent to 77.9 percent (Alpaslan et al. 2014; Bilir et al. 2020; Daşıkan 2021; Yüksekol, Zelal, and Nazik 2021).

The physical symptoms of PMS are changes in appetite, breast tenderness, pain, fatigue, abdominal bloating, and changes in sleep patterns. The behavioral and/or psychological symptoms of PMS are irritability, social isolation, anxiety, and depressive mood and thoughts (Ramya, Rupavani, and

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Bupathy 2016; Saidan et al. 2020). These symptoms negatively affect general health, social relations, self-confidence, academic performance, and quality of life, especially in young women (Abay and Kaplan 2021; Ramya, Rupavani, and Bupathy 2016).

Although the pathophysiology of PMS is not clearly understood, it is negatively affected by hormonal irregularities, serotonergic and dysfunction of gamma-aminobutyric acid, stress, and wrong lifestyle choices (Hantsoo and Epperson 2020; Takeda, Kai, and Yoshimi 2021). According to previous studies, psychological distress causes menstrual cycle irregularity, changes the amount of bleeding, and increases the severity of PMS with related symptoms (Phelan, Behan, and Owens 2021; Takeda, Kai, and Yoshimi 2021) because stressors stimulate the hypothalamic-pituitary-gonadal axis and change the neuromodulatory cascade regulating the gonadotropin-releasing hormone (Williams, Berga, and Cameron 2007). Moreover, cortisol levels rise during stressful life events, exacerbating premenstrual symptoms. Premenstrual symptoms, such as anger and irritability, are linked to a decline in brain serotonin function caused by stress, which worsens mood symptoms (Puthusserry and Delariarte 2022). Therefore, people who experience stressful life events are more likely to suffer from PMS symptoms.

The COVID-19 pandemic has been a stressful time for everybody. It has significantly impacted millions of people, causing loneliness, social isolation, anxiety, fear, financial problems, and uncertainty (Savitsky et al. 2020). Research shows that the prevalence of pandemic-related psychological distress among women ranges from 42.8 percent to 97 percent (Savitsky et al. 2020; Son et al. 2020). Especially young women have suffered a great deal of psychological distress due to sudden school closures, social isolation, wearing masks, online learning, the ambiguity of the future, domestic abuse, etc. (Guessoum et al. 2020). The pandemic and preventive measures have led to fear and anxiety (Andrade et al. 2022; Renström and Bäck 2021; Ypsilanti et al. 2021). Fear is related to the pandemic (Renström and Bäck 2021). Rodriguez-Hidalgo et al. (2020) reported that people with a heightened fear of the pandemic experienced higher levels of psychological distress. Adolescence is a stressful transitional period (Takeda, Kai, and Yoshimi 2021). Therefore, the pandemic has negatively affected college students both physically and mentally (Wang et al. 2020), resulting in fear of COVID-19 (Takeda, Kai, and Yoshimi 2021).

Although there is a body of research on the impact of the pandemic on PMS-related (Kartal and Kaykisiz 2020; Phelan, Behan, and Owens 2021) and menstrual cycle-related symptoms (Bruinvels et al. 2021; Buran and Gerçek Öter 2022), there is no sufficient evidence to suggest the impact of the fear of COVID-19 on PMS and related symptoms (Takeda, Kai, and Yoshimi 2021). However, researchers have dedicated themselves to understanding female reproductive health in the last few decades. Today, scientists have focused their attention on the impacts of the pandemic on female reproductive systems (Li et al. 2021). The pandemic has drastically impacted the lives of university students. Therefore, the main aim of this study is to assess the association between fear of COVID-19 and PMS among university students. The second aim of this study was to examine the prevalence of PMS and the effects of the COVID-19 pandemic on the menstrual cycle-related symptoms.

Materials and methods

Research type and sampling

This cross-sectional research was carried out in the 2020–2021 academic year between March 1 and 30, 2021. The study population consisted of all female students ($N = 996$) of the Health Services Vocational School of a public university in Kırsehir, Turkey. The inclusion criteria were as follows: (1) no pregnancy or lactation in the last 12 months and (2) no gynecologic disorders (abnormal uterine bleeding, myoma, polycystic ovary syndrome, etc.). The sample size can be calculated using the formula "estimation of sampling number when the target population is known" [n= Nt2.p.q)/(N-1).d2+ t2.p.q] (Beins 2017). According to the formula, a sample of 277 would be large enough to detect significant differences (true value: 5 percent and confidence level:

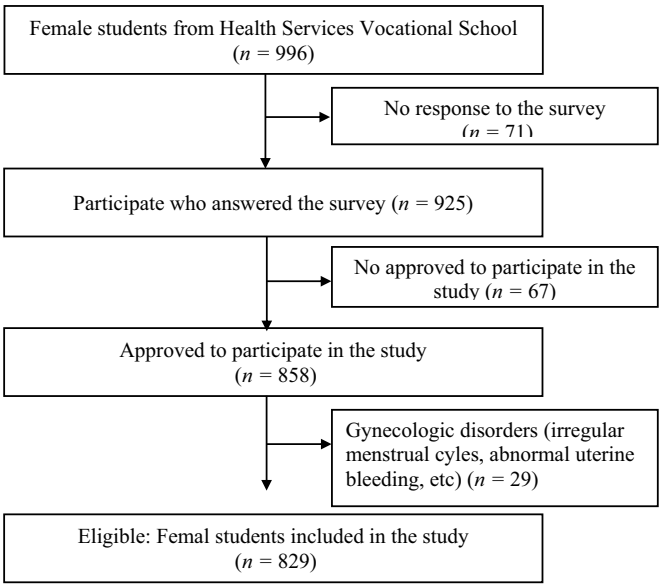

Figure 1. Flow chart of the study.

95 percent). However, we did not recruit participants based on the formula because we aimed to reach the whole study population as we focused on evaluating the prevalence of PMS. Seventy-one students did not reply back. Sixty-seven students declined to participate in the study. Twenty-nine of them stated that they had gynecological disorders. Therefore, one hundred and sixty-seven students were excluded. The sample consisted of 829 students (83 percent participation rate) (Figure 1). The sample size was large enough because it was greater than the sample size calculated using the formula.

Data collection

The data were collected using a survey. The data collection form consisted of three sections: The Questionnaire Form, the Premenstrual Syndrome Scale (PMSS), and the Fear of COVID-19 Scale (FCoV-19S).

The Questionnaire Form was based on a literature review conducted by the researchers (Li et al. 2021; Ramya, Rupavani, and Bupathy 2016; Savitsky et al. 2020; Son et al. 2020). The questionnaire consisted of 18 items on demographic characteristics (marital status, family type, income status, history of Covid-19 infection, etc.) and PMS/menstrual period characteristics (the length of menstrual cycle and bleeding, PMS, dysmenorrhea level, etc.). The questionnaire included the Visual Analogue Scale (VAS) to assess participants' dysmenorrhea levels (on a scale of 1 to 10) before and during the pandemic. The questionnaire also asked participants to rate on a scale of 1 to 10 the level of PMS-related discomfort before and during the pandemic.

The Premenstrual Syndrome Scale (PMSS) was developed by Gençdoğan (2006). The scale assesses premenstrual symptoms and their severity. Since its development, the PMSS has been used in many studies (Bilir et al. 2020; Isgin-atici et al. 2020). The scale is composed of 44 items and nine subscales (1) depressive feeling, (2) anxiety, (3) fatigue, (4) irritation, (5) depressive thoughts, (6) pain, (7) appetitive changes, (8) sleep changes, and (9) bloating. The PMSS is scored on a five-point Likert-type scale. The total score ranges from 44 to 222. A score higher than 110 indicates PMS. Higher scores indicate more severe PMS symptoms. Gençdoğan (2006) found that the scale had a Cronbach's alpha of 0.75 (Gençdoğan 2006) which was 0.97 in this study.

The Fear of COVID-19 Scale (FCoV-19S) was developed by Ahorsu et al. (2020) and adapted into Turkish by Satici et al. (2021). The scale has seven items rated on a scale of 1 to 5. The total score ranges from 7 to 35. Higher scores indicate higher levels of fear of COVID-19. Ahorsu et al. (2020) and Satici et al. (2021) found the Cronbach's alpha of the scale to be 0.82 and 0.88, respectively, which was 0.87 in this study.

Procedure

Participants were recruited from 1 March 2021, until 30 March 2021. The data were collected online due to the pandemic. The researchers created a questionnaire on Google Forms. Students were informed of the study and sent the data collection form through e-mail or WhatsApp. Participants were able to fill out the data collection forms from any device (computer, tablet, phone, etc.) through which they had access to their e-mail or WhatsApp account. A reminder link was sent to those who did not fill out the data collection form within a week. The first page of the data collection form was a consent form that briefed all students about the research aim and procedure. Students who volunteered clicked the "Agree" button, whereas those who declined participation clicked the "Decline" button. Students who declined to participate were thanked and excluded from the data collection process. Afterward, participants were directed to the inclusion criteria section. Students who failed to meet the inclusion criteria were thanked and excluded from the data collection process. Those who met the inclusion criteria had access to the data collection form. Each participant completed the form only once and answer all questions. They could not send back the form unless they answered all questions. Therefore, all participants filled out the form completely. The data were kept confidential. Only the researchers had access to it through their e-mail accounts. Participants could send back the survey forms only online. None of the forms was printed. Data collection lasted 10–15 minutes.

Ethical considerations

This study was approved by the Ethics Committee of X University, Social and Human Sciences (Date: 26 February 2021, & No: 2021/133) and carried out according to the ethical standards. The participants were briefed on the research purpose. Online consent was obtained from all participants. Once students clicked on the link, they were directed to an informed consent page. The consent form informed them that participation was voluntary and that they had the right to decline participation or withdraw from the study at any time. The form also underlined the use of anonymous questionnaires and the confidentiality of questionnaire information. At the end of the informed consent, students were required to agree or decline to participate. Students who declined to participate in the study were redirected to a thank you page. There was no conflict of interest between the researchers and students.

Analysis

The data were analyzed by using Statistical Package for Social Sciences version 24.0 at a significance level of 0.05. Mean and standard deviation was used for descriptive variables. Numbers and percentages were used for categorical variables. The Shapiro – Wilk test and skewness and kurtosis were used for normality testing. The skewness and kurtosis ranged from ±2, indicating normal distribution (George and Mallery 2010). Therefore, parametric tests were used for analysis. The independent samples *t*-test, Pearson's correlation, one-way variance analysis (ANOVA), and Tukey test were used to detect significant differences.

Results

Participants had a mean age of 20.79 ± 2.22. Most participants were single (97.3 percent) and had a nuclear family (81.1 percent). More than half the participants (68.4 percent) had a moderate income. Only a small portion of the participants (6.3 percent) had tested positive for COVID-19. Three participants were treated at the hospital. More than half the participants reported no change in the length of their menstrual cycles (72.5 percent) and bleeding (79.6 percent). More than half of the participants noted that the pandemic did not affect their menstrual cycles (Table 1).

Participants had a mean FCoV-19S 19.00 ± 5.62. Participants with extended families had a higher mean FCoV-19S score (20.48 ± 5.96) than those with nuclear (18.09 ± 6.44) and broken families (17.81 ± 5.63) (p = .007). Participants who were hospitalized for COVID-19 had a higher mean FCoV-19S score (27.67 ± 7.50) than those who were treated at home (19.49 ± 5.99) (p = .021). Participants who expressed longer menstrual cycles and bleeding since the onset of the pandemic had a higher mean FCoV-19S score than others (p< .01). Moreover, participants who thought that the pandemic negatively affected their menstrual cycles had a higher mean FCoV-19S score than those who did not (p = .000). Participants had a mean PMSS score of 135.12 ± 41.07. Participants who reported no change in the length of their menstrual cycles since the onset of the pandemic had a lower mean PMSS score (129.64 ± 39.93) than those who reported longer (151.00 ± 39.06) and shorter

Table 1. FCoV-19S and PMSS scores by variables (n = 829).

		FCoV-19S		PMSS	
Variables	n (%)	Mean ± SD	Analysis[a]	Mean ± SD	Analysis[a]
Marital status					
Married	22 (2.7)	18.99 ± 5.59	t= −.385	135.22 ± 41.07	t= −.280
Single	807 (97.3)	19.45 ± 6.76	p= .701	137.72 ± 42.62	p= .789
Family type					
Nuclear	672 (81.1)	18.86 ± 5.52	F = 5.052	134.55 ± 40.81	F = 1.990
Extended	105 (12.7)	20.48 ± 5.96	p= .007*	133.42 ± 41.65	p= .137
Broken	52 (6.3)	17.81 ± 5.63		146.01 ± 42.59	
Income status					
Good	210 (25.3)	19.11 ± 5.69	F= .106	139.98 ± 43.45	F = 2.624
Moderate	567 (68.4)	18.94 ± 5.63	p= .899	134.01 ± 40.23	p= .073
Poor	52 (6.3)	19.19 ± 5.25		127.25 ± 39.05	
Testing positive for COVID-19					
Yes	135 (16.3)	19.67 ± 6.11	t = 1.525	137.22 ± 40.73	t = 0.648
No	694 (83.7)	18.87 ± 5.51	p= .128	134.71 ± 41.16	p= .517
Hospitalization due to COVID-19					
Yes	3 (2.2)	27.67 ± 7.50	t= −2.328	158.67 ± 65.96	t= −.574
No	132 (97.8)	19.49 ± 5.99	p= .021*	136.73 ± 40.25	p= .358
Menstrual cycle duration during the COVID-19 pandemic compared to before the pandemic (day)					
Longer (a)	161 (19.4)	20.15 ± 6.86	F = 6.003	151.00 ± 39.06	F = 20.73
No change (b)	601 (72.5)	18.59 ± 5.11	p= .003*	129.64 ± 39.93	p= .000**
Shorter (c)	67 (8.1)	19.94 ± 6.24	Differences *(a-b; a-c)*	146.15 ± 44.30	Differences *(a-b; b-c)*
Menstrual bleeding duration during the COVID-19 pandemic compared to before the pandemic (day)					
Longer (a)	72 (8.7)	21.93 ± 7.56	F = 12.633	166.26 ± 43.22	F = 32.315
No change (b)	660 (79.6)	18.58 ± 5.27	p= .000**	129.96 ± 39.00	p= .000**
Shorter (c)	97 (11.7)	19.66 ± 5.57	Differences *(a-b; a-c)*	147.13 ± 41.08	Differences *(a-b;a-c;b-c)*
The COVID-19 pandemic affecting your menstrual cycle					
No (a)	583 (70.3)	18.19 ± 5.09	F = 23.292	127.74 ± 39.36	F = 34.342
Positively (b)	18 (2.2)	18.33 ± 5.81	p= .000**	151.71 ± 41.51	p= .000**
Negatively (c)	228 (27.5)	21.11 ± 6.32	Difference *(a-c)*	152.71 ± 41.08	Differences *(a-b; a-c)*

FCoV-19S: Fear of COVID-19 Scale; PMSS: Premenstrual Syndrome Scale; SD: standard deviation.
[a]Independent t Test; One-way ANOVA Test.
*p < .05; **p < .001.

(146.15 ± 44.30) menstrual cycles (p = .000). Participants who reported no change in the length of menstrual bleeding since the onset of the pandemic had a lower mean PMSS score (129.96 ± 39.00) than those who reported longer (166.26 ± 43.22) and shorter (147.13 ± 41.08) menstrual cycles (p = .000). Marital status, income, and testing positive for COVID-19 had no effect on participants' FCoV-19S and PMSS scores (p > .05) (see Table 1).

The prevalence of PMS was 73 percent (PMSS score ≥111). Based on the PMSS scores, participants experienced fatigue (79.4 percent), irritability (79 percent), changes in appetite (76.5 percent), depressive mood (71.4 percent), swelling (70.6 percent), pain (68.9 percent), changes in sleep patterns (57.1 percent), depressive thoughts (56.2 percent), and anxiety (43.1 percent). Participants with PMS had a higher mean FCoV-19S score (19.30 ± 4.69) than those without PMS (17.31 ± 5.72) (p = .000). Participants who experienced depressive mood, fatigue, pain, sleep changes, depressive thoughts, irritability, anxiety, appetite changes, and swelling during their periods had higher FCoV-19S scores than those who did not (p < .000) (see Table 2).

Table 2. Distribution of FCoV-19S scores by PMSS scores (n = 829).

		FCoV-19S	
PMSS/Subscales	*n* (%)	Mean ± SD	Analysis†
PMS			
Yes	605 (73.0)	19.68 ± 5.76	t= -6.321
No	224 (27.0)	17.17 ± 4.77	*p*= .000**
Depressive mood			
Yes	592 (71.4)	19.46 ± 5.83	t= -4.055
No	237 (28.6)	17.85 ± 4.86	*p*= .000**
Anxiety			
Yes	357 (43.1)	20.44 ± 6.35	t= -5.334
No	472 (56.9)	17.91 ± 4.71	*p*= .000**
Fatigue			
Yes	658 (79.4)	19.45 ± 5.69	t= -4.531
No	171 (20.6)	17.29 ± 4.99	*p*= .000**
Irritability			
Yes	655 (79.0)	19.31 ± 5.80	t= -3.616
No	174 (21.0)	17.80 ± 4.67	*p*= .000**
Depressive thoughts			
Yes	466 (56.2)	20.00 ± 6.06	t= -6.144
No	363 (43.8)	17.71 ± 4.68	*p*= .000**
Pain			
Yes	571 (68.9)	19.60 ± 5.73	t= -4.652
No	258 (31.1)	17.67 ± 5.11	*p*= .000**
Appetite changes			
Yes	634 (76.5)	19.37 ± 5.69	t= -3.449
No	195 (23.5)	17.79 ± 5.19	*p*= .001*
Sleep changes			
Yes	473 (57.1)	19.77 ± 6.02	t= -4.758
No	356 (42.9)	17.97 ± 4.84	*p*= .001*
Swelling			
Yes	585 (70.6)	19.41 ± 5.81	t= -3.528
No	244 (29.4)	18.00 ± 4.99	*p*= .000**

FCoV-19S: Fear of COVID-19 Scale; PMSS: Premenstrual Syndrome Scale; SD: standard deviation.
†Independent t Test.
*p < .05; **0.001.

Table 3. Correlation between scale scores (n = 829).

Variables	Mean	SD	1	2	3	4	5	6	7	8
1. FCoV-19S	19.0	5.62	1							
2. PMSS	135.12	41.07	,251**	1						
3. VAS-1[a]	6.99	2.19	,017	,407**	1					
4. VAS-2[b]	7.18	2.15	,141**	,556**	,739**	1				
5. VAS-3[c]	6.46	2.27	-,080*	,171**	,481**	,340**	1			
6. VAS-4[d]	7.02	2.27	,099**	,294-	,311**	,452**	,736**	1		
7. Age	13.39	1.40	,024	,019**	,024	-,043	,015	-,043	1	
8. Age of menarche	20.79	2.22	-,012	-,046	,028	,037	,007	,033	,011	1

FCoV-19S: Fear of COVID-19 Scale; PMSS: Premenstrual Syndrome Scale; PMS: Premenstrual Symptoms; VAS: Visual Analogue Scale.
[a]VAS score for PMS-related discomfort before the COVID-19 pandemic; Min = 1 (none) and Max = 10 (highest).
[b]VAS score for PMS-related discomfort during the COVID-19 pandemic; Min = 1 (none) and Max = 10 (highest).
[c]VAS score for dysmenorrhea before the COVID-19 pandemic; Min = 1 (no pain) and Max = 10 (worst pain).
[d]VAS score for dysmenorrhea during the COVID-19 pandemic; Min = 1 (no pain) and Max = 10 (worst pain).
* p <.05; **p < .001 (Pearson's correlation).

They had a mean PMS-related discomfort score of 6.99 ± 2.19 and 7.18 ± 2.15 before and during the pandemic, respectively. They had a mean dysmenorrhea VAS score of 6.46 ± 2.27 and 7.02 ± 2.27 before and during the pandemic, respectively. FCoV-19S scores were weakly correlated with PMS scores, moderately correlated with PMS-related discomfort scores, and weakly correlated with dysmenorrhea VAS scores (p < .001). There was no relationship between age and menarche age and scale scores (see Table 3).

Discussion

This study had three key findings. First, the prevalence of PMS was 73 percent, and the most common symptoms were fatigue, irritability, appetite changes, and depression, Second, the fear of COVID-19 significantly affected PMS and related symptoms. Third, more than half the participants stated no change in the length of the menstrual cycle and bleeding. Participants who stated changes in the length of their menstrual cycles and bleeding during the pandemic had higher FCoV-19S than those who reported no change.

First, the prevalence of PMS was 73.0 percent among our participants. The global prevalence of PMS is 47.8 percent. According to earlier studies, the prevalence of PMS is 12 percent in France, 21 percent in China, 73 percent in Spain, 98 percent in Iran (Direkvand-Moghadam et al. 2014), 31 percent in the United States (Vichnin et al. 2006), and 47.1 percent in Saudi Arabia (Bakhsh et al. 2020). The prevalence of PMS in Turkey ranged from 61.1 percent to 71.3 percent reported by pre-pandemic studies (Alpaslan et al. 2014; Bilir et al. 2020; Daşıkan 2021). In their meta-analysis, Erbil and Yücesoy (2021) have reported that the prevalence of PMS is 52.2 percent in Turkey. There is limited research conducted during the pandemic. For example, Yüksekol, Zelal, and Nazik (2021) determined that the prevalence of PMS among Turkish university students was 77.9 percent. Aolymat, Khasawneh, and Al-Tamimi (2022) reported that PMS was more common during the pandemic than before. The studies conducted before the pandemic reported a lower prevalence of PMS. Therefore, the high prevalence of PMS reported by recent studies may be due to the adverse impact of the pandemic. Another reason may be that researchers recruited participants with different socio-demographic characteristics and used different measurement tools. Although the results are different, research indicates that the prevalence of PMS is high.

The most common PMS symptoms among our participants during the pandemic were fatigue, irritability, changes in appetite, depressive mood, swelling, pain, changes in sleep patterns, and depressive thoughts. However, only a handful of studies address PMS symptoms during the pandemic. For example, Kartal and Kaykisiz (2020) reported that young women mainly experienced psychosocial problems, such as depressive mood and thoughts, anxiety, irritability, and changes in sleep patterns. Bruinvels et al. (2021) also found that the most common menstrual cycle-related symptoms were

psychosocial problems, such as mood swings, irritability, emotional feeling, worry, and lack of concentration. These results show that, despite social differences, menstruation-related symptoms during the pandemic are similar and are mostly of psychosocial origin.

Second, participants had a moderate fear of COVID-19, which significantly affected PMS and related symptoms. The pandemic has caused further stressors, such as worry and fear for oneself or loved ones (Ahorsu et al. 2020). It has also introduced restrictions on social life and caused sudden and radical lifestyle changes (Brooks et al. 2020). Research also shows that the pandemic has taken the greatest toll on the young population (Savitsky et al. 2020; Tasso, Hisli Sahin, and San Roman 2021; Wang et al. 2020) and caused fear (Doğanülkü et al. 2021; Takeda, Kai, and Yoshimi 2021). In their meta-analysis, Luo et al. (2021) have found that university students have a mean FCoV-19S score of 17.75. They have also reported that Asian, American, European, and Australian students have a mean FCoV-19S score of 18.36, 18.25, 17.68, and 17.43, respectively. Moreover, Tan et al. (2021) and Karakuş, Apaydın, and Cevahircioğlu (2021) reported that Turkish students had a mean FCoV-19S score of 17.10 and 15.63, respectively. Our participants had a mean FCoV-19S score of 19.00, which was higher than those reported by earlier studies. This may have four reasons. First, there was a high level of uncertainty surrounding the pandemic during the time we collected data. Second, there was no widespread vaccination and no medications against the coronavirus yet. Third, the government had enforced strict preventive measures. Fourth, the pandemic had dramatically affected the education system.

Fear is related to the COVID-19 pandemic (Broche-Pérez et al. 2022; Serafini et al. 2020). Our participants with PMS had higher FCoV-19S scores than those without PMS. In addition, there was a positive correlation between FCoV-19S and PMS scores. Although there is a body of research on the effect of the pandemic on PMS-related symptoms (Kartal and Kaykisiz 2020; Phelan, Behan, and Owens 2021), there is no sufficient evidence suggesting a correlation between COVID-19 fear and PMS (Takeda, Kai, and Yoshimi 2021). Takeda, Kai, and Yoshimi (2021) reported a strong positive correlation between posttraumatic stress symptoms and COVID-19 fear in Japanese high school students. They also found that the more the posttraumatic stress symptoms, the more severe the PMS-related symptoms. Takeda and Shiina (2018) also showed that pandemics and natural disasters could cause young women to experience severe PMS-related symptoms. Therefore, authorities should develop strategies to help university students maintain and improve their mental health in times of crisis, such as pandemics, natural disasters, etc. The government and universities should work together to provide university students with psychological counseling services on times of crisis.

The menstrual cycle is regulated by the ovary and is affected by internal and external factors (Kala and Nivsarkar 2016). Finally, most of our participants interestingly reported no change in their menstrual cycles and bleeding times during the pandemic than before. They stated that the pandemic did not affect their menstrual cycles. Yüksekol, Zelal, and Nazik (2021) also reported that almost four out of five students (77.1 percent) had no change in the length of their menstrual cycles during the pandemic. Li et al. (2021) found that most women who tested positive for COVID-19 did not experience any change in menstruation volume (75 percent) and menstrual cycle length (72 percent). They also found no difference in sex hormones and anti-müllerian hormone concentrations between women who tested positive for COVID-19 and those who did not. Phelan, Behan, and Owens determined no change in the number of the days of menstrual bleeding in women between before and during the pandemic but detected shorter menstrual cycles during the pandemic than before. Our participants who reported changes in the length of their menstrual cycles and bleeding during the pandemic had higher FCoV-19S than those who reported no change. These results suggest that pandemic-related fear causes menstrual changes.

The study had four limitations. First, the findings cannot be generalized because the sample consisted of students of health-related departments. Second, the fear of COVID-19 was assessed based on self-report, which might have led to a biased result. However, all studies conducted during the pandemic use self-assessment scales to screen psychological problems (Martinez-Lorca et al. 2020; Nguyen et al. 2020; Perz, Lang, and Harrington 2020). Future studies should use different methods to

clinically assess students' fear of COVID-19. Third, the menstrual period characteristics before and during the pandemic were based on self-report. Future studies should employ evidence-based techniques (diaries, apps, etc.) to collect data. Fourth, we did not focus on psychological disorders when recruiting participants. Therefore, future studies should exclude those with psychological disorders. This study had two strengths. First, the participation rate was high (83 percent) (n = 829). Second, the study looked into the effect of fear of COVID-19 on menstrual cycle length, amount of bleeding, and dysmenorrhea. We think that the results on the impact of the pandemic on menstrual cycle will make a significant contribution to the literature. Moreover, we could comprehend the impact of the pandemic on PMS and menstrual cycle because we performed the research in the second year of the pandemic. However, PMS may have more severe effects in the long term. Therefore, researchers must look into the long-term impact of the fear of COVID 19 on PMS.

Conclusion

In conclusion, this study revealed that the prevalence of PMS was 73 percent. Participants had a moderate fear of COVID-19. The fear of COVID-19 affected PMS and menstrual cycle-related symptoms. The results suggest that authorities should consider that the prevalence of PMS increases due to fear of stressful life events (e.g., pandemics) and provide psychosocial support and professional counseling when necessary.

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