Comparison of Menstruation-Related Symptoms Before and During Menstruation of University Students in Japan, a Year after the COVID-19 Pandemic

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Abstract

The coronavirus disease 2019 (COVID-19) pandemic affected the daily lifestyle of people, including many aspects affecting young women. Subsequent to the COVID-19 pandemic stress and anxiety have been reported related to menstrual disorders (Takmaz, Gundogmus, Okten, & Gunduz, 2021). The purpose of this study was to investigate the intensity and to compare menstruation-related symptoms before and during menstruation among university students in Japan. We conducted an online cross-sectional study from May to July 2021 using a menstrual distress questionnaire (MDQ) to assess symptoms experienced before and during menstruation. Our results showed that of 141 students, five students (3.5%) did not report any symptoms before menstruation and one student (0.7%) had no symptoms during menstruation. We found that the most frequently experienced symptoms before menstruation were skin blemishes or disorder, mood swings, irritability, swelling, cramps, fatigue, take naps, stay in bed, feeling sad or blue, weight gain and difficulty concentrating. The most frequently experienced symptoms during menstruation were cramps, fatigue, irritability, mood swings, take naps, stay in bed, feeling sad or blue, backache, swelling, skin blemish or disorder, and poor school/work performance. The total MDQ score was significantly higher during menstruation than before menstruation. Among the MDQ eight scales, the scores of five scales including pain, autonomic reaction, impaired concentration, behavior change, and control were significantly higher during menstruation than before menstruation. The prevalence of increased appetite and craving for sweets were higher than MDQ symptoms before menstruation. The prolonged exposure to pandemic may have more effect on psychological symptoms than on physical symptoms.

Keywords: COVID-19 pandemic, menstruation-related symptoms, menstrual distress questionnaire, young women

1. Introduction

Since the declaration of the coronavirus disease 2019 (COVID-19) pandemic by the World Health Organization (WHO) on March 11, 2020, the lifestyle of people has undergone many changes. The COVID-19 pandemic has influenced students' lifestyle as well as their physical and mental health. For university students, various changes in their academic life occurred, such as restrictions in access to campus and increased online classes. A prospective cohort study conducted before and during the COVID-19 lockdown amongst university students in Saudi Arabia showed that physical activity had decreased, sedentary time had increased, and that although their level of sleeping had decreased but sleeping time had increased (Jalal, Beth, Al-Hassan, & Alshealah, 2021). A cross-sectional survey amongst medical students in nine countries including Japan reported that 90% of respondents mentioned a transition to online education, and 96% of students increased their time spent in front of screens such as computers, cell phones, tablets, and others electronic devices (Perez-Dominguez et al., 2021). The same study also reported that about a half of the students reported negative changes in their studying, sleeping and eating habits, and they frequently experienced the onset and increasing mental and physical health symptoms such as backache, asthenopia, irritability, and emotional instability (Perez-Dominguez et al., 2021).

There were some reports regarding the association of the COVID-19 pandemic with menstruation and menstruation-related symptoms including premenstrual syndrome (PMS), premenstrual dysphoric disorder (PMDD) and dysmenorrhea, which affected the daily and academic life of young women, such as being absent from school (Armour et al., 2019; Tadakawa, Takeda, Monma, Koga, & Yaegashi, 2016) or by the negative effects on their concentration (Armour et al., 2019). It was reported that for women in Turkey, duration of menstruation decreased compared to their experiences before the COVID-19 outbreak and the severity of anxiety and stress positively correlated with the degree of menstrual and somatic symptoms (using the menstruation symptom questionnaire -MSQ) (Demir, Sal, & Comba, 2021). It was reported that 53% of women in Ireland had worse premenstrual symptoms and 30% women had new dysmenorrhea after the pandemic breakout (Phelan, Behan, & Owens, 2021). Moreover, the number of women having mental health symptoms increased, and the women with mental health symptoms were also more likely to report painful periods and worsening premenstrual symptoms (Phelan et al., 2021). It was further reported that female healthcare workers in Turkey had an association between the COVID-19 pandemic-induced anxiety, perceived stress, depressive symptoms, and increased prevalence of menstrual cycle irregularity (Takmaz, Gundogmus, Okten, & Gunduz, 2021). A longitudinal study in Brazil before and during pandemic also showed that the total premenstrual screening tool score showed no change in the presence and severity of premenstrual symptoms between the two periods, but that the "anxiety/stress" symptoms of this tool revealed that it was more severe in the students before the pandemic (Freitas, de Medeiros, & Lopes, 2021). Thus, stress and anxiety may be related to menstrual abnormality during the pandemic. Since more than a year of the COVID-19 pandemic has passed, students, however, may be getting used to coexisting with COVID-19 with less anxiety. Although menstrual cycle-related symptoms include physical, behavioral, and emotional symptoms (Clayton, 2008), to our knowledge, comparison of menstruation-related symptom in young women between before and during menstruation have not been reported.

This study therefore aimed to investigate the intensity of menstruation-related symptoms before and during menstruation and to compare menstrual symptoms before and during menstruation in Japanese university students, a year after the start of the COVID-19 pandemic.

2. Materials and Methods

2.1 Participants

We recruited young female university students who were enrolled in the health science department of a university in Japan. For the purpose of recruitment, we announced the recruitment during online classes or face-to-face classes with the 320 students. After these sessions, 169 students agreed to participate voluntarily.

2.2 Data Collection Procedure

Data collection for this study was conducted between May to July 2021.The questionnaire for survey was created by the authors, then converted into the online form by using SurveyMonkey (https://jp.surveymonkey.com/).

The researchers provided an explanation relating to the purpose of the survey and the protocol and then asked students to participate in the survey. The study was anonymous and completely voluntary. All questions were compulsory, but it was possible to quit the questionnaire at any time. Students could access the online survey by clicking on the URL or scanning the QR code provided. Students needed to check a button for informed consent before answering the survey questions; they could continue the survey once they had provided informed consent, or if not they could end their participation. The study was approved by the Ethics Committee of Tokushima University Hospital (approval number: 3932).

2.3 Measurements

2.3.1 Demographic Characteristics

For this study, we developed a questionnaire consisting of demographic information including age, body weight, body height, age of menarche, currently visiting gynecological doctors and taking hormone therapy, present menstrual conditions (menstrual cycle length, regularity, duration of menstrual bleeding and perceived amount of menstrual bleeding). Body Mass Index (BMI) was calculated as the body weight(kg)/body height (m^2).

2.3.2 Menstruation-Related Measurements

This part of the questionnaire consisted of questions on information about the intensity of menstruation-related symptoms. The intensities of menstruation-related symptoms were assessed using the menstrual distress questionnaire (MDQ). The MDQ which has been a standard method widely used for measuring menstruation-related symptoms (Moos, 1968) contains 46 symptom items grouped into eight scales. Among the eight scales, three somatic scales are for pain, water retention, and autonomic reactions, another three scales are for

mood and behavioral changes, specifically negative affect, impaired concentration and behavior change. The last two scales are for arousal and control (Moos, 2010). Students were asked to rate their perceived intensity of each item during three menstrual phases including before menstruation (4 days before mensuration), during menstruation and the remainder of the cycle. For each item, the participants could rate their experiences on a five-point scale from 0 to 4, where 0 was no experience of symptom, 1 was present and mild, 2 was present and moderate, 3 was present and strong and 4 was present and severe. The Cronbach's alpha coefficient in this study was 0.84 and 0.86 for total MDQ score before and during menstruation, respectively. We also investigated three eating habit symptoms, comprising an increase in appetite, craving for sweets and snacks, which we found specific change before and during menstruation (Matsuura, Inoue, Kidani, & Yasui, 2020). Each symptom was also rated on a five-point scale.

2.4 Statistics Analysis

We performed the statistical analysis using SPSS version 28.0 for Windows (IBM Corp., Armonk, NY, USA). Categorical variables were presented as whole numbers with percentages or means with standard deviations. The MDQ score was calculated by total score and score for each of the eight scales, presented as median (25th percentile, 75th percentile). The three eating habit symptoms were also presented in the same way. We used the Wilcoxon signed rank test to compare the intensity of MDQ total score, each of the eight scales' score and three eating habit symptoms' score before and during menstruation. All p-values < 0.05 were regarded as statistically significant.

3. Results

We recruited from 320 female students for the survey, of whom 169 students participated in the study. We excluded 28 students, comprising 18 students who did not complete the MDQ items and 10 students who were under hormonal therapy for their gynecological diseases. Subsequently, we used the data of 141 students for analysis.

3.1 Demographic Characteristics

The mean age of the students was 19.8 ± 3.1 years, and the mean menarche age was 12.1 ± 1.4 years. Among them, 87.9% of students reported that their menstrual cycle length ranged from 25 to 38 days. Menstrual duration for most of the students ranged from 3 to 7 days. The amount of menstrual bleeding was perceived as moderate by 75.9% of the students (Table 1).

Table 1. Demographic characteristics (n=141)

Characteristic	Category	n	%
Age (years)[a]		19.8 (3.1)	
Height (cm) [a]		157.4 (4.9)	
Weight (kg) [a]		51.4 (6.2)	
Menarche age (years) [a]		12.1 (1.4)	
Body mass index (kg/m^2) [a]		20.7 (2.1)	
Menstrual cycle length	24 days or less	2	1.4
	25-38 days	124	87.9
	39 days or more	14	9.9
	No menstruation for more than 3 months	1	0.7
Menstrual cycle regularity	Regular	67	47.5
	Sometimes irregular	65	46.1
	Irregular	9	6.4
Duration of menstruation	3-7 days	137	97.2
	8 days or more	4	2.8
Perceived amount of menstrual bleeding	Light	12	8.5
	Moderate	107	75.9
	Heavy	22	15.6

[a]Mean (standard deviation).

3.2 Prevalence of MDQ Symptoms

Five students (3.5%) did not report any symptoms before menstruation and one student (0.7%) similarly during menstruation. The range of the MDQ total score before menstruation was 0-109 points and the range of the score during menstruation was 0–124 points.

Regarding symptoms before menstruation, the most frequently experienced symptoms were skin blemish or disorder (68.8%), mood swings (68.1%), irritability (63.8%), swelling (62.4%), cramps (61.0%), fatigue, take naps, stay in bed, feeling sad or blue, weight gain and difficulty concentrating (Table 2).

Table 2. Prevalence of MDQ symptoms before menstruation by the level of intensity (n=141)

| Scales | Symptoms | Intensity | | | | | | | | | |
| | | None | | Mild | | Moderate | | Strong | | Severe | |
		n	%	n	%	n	%	n	%	n	%
Pain	Muscle stiffness	120	85.1	15	10.6	3	2.1	2	1.4	1	0.7
	Headache	88	62.4	27	19.1	18	12.8	3	2.1	5	3.5
	Cramps	55	39.0	43	30.5	28	19.9	14	9.9	1	0.7
	Backache	80	56.7	33	23.4	23	16.3	3	2.1	2	1.4
	Fatigue	58	41.1	27	19.1	33	23.4	18	12.8	5	3.5
	General aches and pains	102	72.3	24	17.0	10	7.1	5	3.5	0	0.0
Water retention	Weight gain	75	53.2	31	22.0	17	12.1	15	10.6	3	2.1
	Skin blemish or disorder	44	31.2	32	22.7	33	23.4	25	17.7	7	5.0
	Painful or tender breasts	81	57.4	22	15.6	20	14.2	15	10.6	3	2.1
	Swelling (breasts abdomen)	53	37.6	31	22.0	37	26.2	17	12.1	3	2.1
Autonomic reactions	Dizziness, faintness	89	63.1	28	19.9	16	11.3	7	5.0	1	0.7
	Cold sweats	130	92.2	7	5.0	3	2.1	1	0.7	0	0.0
	Nausea, vomiting	124	87.9	7	5.0	7	5.0	2	1.4	1	0.7
	Hot flashes	106	75.2	15	10.6	16	11.3	2	1.4	2	1.4
Negative affect	Loneliness	93	66.0	14	9.9	21	14.9	6	4.3	7	5.0
	Anxiety	88	62.4	23	16.3	18	12.8	5	3.5	7	5.0
	Mood swings	45	31.9	30	21.3	27	19.1	26	18.4	13	9.2
	Crying	102	72.3	15	10.6	8	5.7	9	6.4	7	5.0
	Irritability	51	36.2	27	19.1	19	13.5	31	22.0	13	9.2
	Tension	102	72.3	17	12.1	13	9.2	7	5.0	2	1.4
	Feeling sad or blue	63	44.7	26	18.4	29	20.6	12	8.5	11	7.8
	Restlessness	101	71.6	21	14.9	14	9.9	2	1.4	3	2.1
Impaired Concentration	Insomnia	111	78.7	12	8.5	15	10.6	2	1.4	1	0.7
	Forgetfulness	124	87.9	7	5.0	9	6.4	0	0.0	1	0.7
	Confusion	110	78.0	16	11.3	10	7.1	2	1.4	3	2.1
	Poor judgment	111	78.7	15	10.6	12	8.5	2	1.4	1	0.7
	Difficulty concentrating	78	55.3	28	19.9	23	16.3	9	6.4	3	2.1
	Distractible	83	58.9	27	19.1	20	14.2	8	5.7	3	2.1
	Minor Accidents	98	69.5	21	14.9	14	9.9	7	5.0	1	0.7
	Poor motor coordination	96	68.1	26	18.4	11	7.8	5	3.5	3	2.1

Scales	Symptoms	None		Mild		Moderate		Strong		Severe	
		n	%	n	%	n	%	n	%	n	%
Behavior change	Poor school/work performance	81	57.4	32	22.7	12	8.5	9	6.4	7	5.0
	Take naps, stay in bed	62	44.0	19	13.5	20	14.2	23	16.3	17	12.1
	Stay at home	89	63.1	16	11.3	18	12.8	11	7.8	7	5.0
	Avoid social activities	93	66.0	24	17.0	14	9.9	9	6.4	1	0.7
	Decreased efficiency	83	58.9	28	19.9	15	10.6	8	5.7	7	5.0
Arousal	Affectionate	88	62.4	20	14.2	21	14.9	6	4.3	6	4.3
	Orderliness	113	80.1	12	8.5	14	9.9	2	1.4	0	0.0
	Excitement	121	85.8	13	9.2	4	2.8	3	2.1	0	0.0
	Feelings of well-being	92	65.2	25	17.7	18	12.8	5	3.5	1	0.7
	Bursts of energy, activity	97	68.8	29	20.6	11	7.8	3	2.1	1	0.7
Control	Feelings of suffocation	123	87.2	8	5.7	8	5.7	2	1.4	0	0.0
	Chest pains	123	87.2	11	7.8	6	4.3	0	0.0	1	0.7
	Ringing in the ears	120	85.1	13	9.2	7	5.0	1	0.7	0	0.0
	Heart pounding	125	88.7	9	6.4	5	3.5	1	0.7	1	0.7
	Numbness, tingling	134	95.0	5	3.5	1	0.7	1	0.7	0	0.0
	Blind spots, fuzzy vision	128	90.8	9	6.4	4	2.8	0	0.0	0	0.0

Subsequently, regarding symptoms during menstruation, the most frequently experienced symptoms were cramps (93.6%), fatigue (77.3%), irritability (75.9%), mood swings (73.8%), take naps, stay in bed (72.3%), feeling sad or blue, backache, swelling (breasts, abdomen), skin blemish or disorder, and poor school/work performance (Table 3).

Table 3. Prevalence of MDQ symptoms during menstruation by the level of intensity (n=141)

Scales	Symptoms	Intensity									
		None		Mild		Moderate		Strong		Severe	
		n	%	n	%	n	%	n	%	n	%
Pain	Muscle stiffness	110	78.0	15	10.6	9	6.4	5	3.5	2	1.4
	Headache	77	54.6	23	16.3	30	21.3	7	5.0	4	2.8
	Cramps	9	6.4	26	18.4	38	27.0	51	36.2	17	12.1
	Backache	42	29.8	24	17.0	29	20.6	31	22.0	15	10.6
	Fatigue	32	22.7	25	17.7	37	26.2	34	24.1	13	9.2
	General aches and pains	74	52.5	28	19.9	27	19.1	9	6.4	3	2.1
Water retention	Weight gain	79	56.0	27	19.1	25	17.7	9	6.4	1	0.7
	Skin blemish or disorder	45	31.9	39	27.7	32	22.7	19	13.5	6	4.3
	Painful or tender breasts	75	53.2	32	22.7	22	15.6	9	6.4	3	2.1
	Swelling (breasts abdomen)	43	30.5	38	27.0	39	27.7	18	12.8	3	2.1
Autonomic reactions	Dizziness, faintness	63	44.7	31	22.0	35	24.8	8	5.7	4	2.8
	Cold sweats	116	82.3	11	7.8	6	4.3	7	5.0	1	0.7
	Nausea, vomiting	107	75.9	15	10.6	13	9.2	3	2.1	3	2.1
	Hot flashes	98	69.5	27	19.1	10	7.1	5	3.5	1	0.7

Negative affect	Loneliness	87	61.7	24	17.0	21	14.9	7	5.0	2	1.4
	Anxiety	81	57.4	32	22.7	20	14.2	6	4.3	2	1.4
	Mood swings	37	26.2	37	26.2	35	24.8	25	17.7	7	5.0
	Crying	103	73.0	20	14.2	7	5.0	9	6.4	2	1.4
	Irritability	34	24.1	43	30.5	30	21.3	22	15.6	12	8.5
	Tension	90	63.8	24	17.0	17	12.1	6	4.3	4	2.8
	Feeling sad or blue	40	28.4	34	24.1	38	27.0	16	11.3	13	9.2
	Restlessness	93	66.0	30	21.3	11	7.8	4	2.8	3	2.1
Impaired Concentration	Insomnia	104	73.8	19	13.5	15	10.6	2	1.4	1	0.7
	Forgetfulness	120	85.1	10	7.1	10	7.1	0	0.0	1	0.7
	Confusion	104	73.8	19	13.5	17	12.1	1	0.7	0	0.0
	Poor judgment	101	71.6	16	11.3	19	13.5	5	3.5	0	0.0
	Difficulty concentrating	53	37.6	27	19.1	37	26.2	20	14.2	4	2.8
	Distractible	61	43.3	33	23.4	31	22.0	13	9.2	3	2.1
	Minor Accidents	87	61.7	23	16.3	24	17.0	5	3.5	2	1.4
	Poor motor coordination	67	47.5	20	14.2	26	18.4	19	13.5	9	6.4
Behavior change	Poor school/work performance	45	31.9	36	25.5	34	24.1	12	8.5	14	9.9
	Take naps, stay in bed	39	27.7	26	18.4	30	21.3	25	17.7	21	14.9
	Stay at home	66	46.8	20	14.2	22	15.6	20	14.2	13	9.2
	Avoid social activities	82	58.2	21	14.9	17	12.1	16	11.3	5	3.5
	Decreased efficiency	61	43.3	27	19.1	30	21.3	15	10.6	8	5.7
Arousal	Affectionate	89	63.1	26	18.4	15	10.6	6	4.3	5	3.5
	Orderliness	117	83.0	9	6.4	14	9.9	1	0.7	0	0.0
	Excitement	128	90.8	9	6.4	3	2.1	1	0.7	0	0.0
	Feelings of well-being	96	68.1	25	17.7	16	11.3	4	2.8	0	0.0
	Bursts of energy, activity	113	80.1	19	13.5	7	5.0	2	1.4	0	0.0
Control	Feelings of suffocation	123	87.2	6	4.3	7	5.0	2	1.4	3	2.1
	Chest pains	122	86.5	10	7.1	8	5.7	0	0.0	1	0.7
	Ringing in the ears	119	84.4	15	10.6	6	4.3	1	0.7	0	0.0
	Heart pounding	118	83.7	13	9.2	7	5.0	2	1.4	1	0.7
	Numbness, tingling	135	95.7	1	0.7	3	2.1	2	1.4	0	0.0
	Blind spots, fuzzy vision	126	89.4	10	7.1	4	2.8	1	0.7	0	0.0

3.3 Comparison of MDQ Symptoms' Intensities Before and During Menstruation

The total MDQ score was significantly higher during menstruation than before menstruation. Among eight scales, the scores of five scales including pain, autonomic reaction, impaired concentration, behavior change, and control were significantly higher during menstruation than before menstruation. In contrast, the score of arousal was significantly higher before menstruation than during menstruation (Table 4).

Table 4. Comparison of MDQ symptoms' intensities before and during menstruation by subcategory (n=141)

Scales	No. of symptoms	Before menstruation			During menstruation			p-value[*]
Pain	6	3.0	(1.0,	6.0)	7.0	(4.0,	11.0)	<0.001
Water retention	4	3.0	(2.0,	7.0)	4.0	(1.0,	6.0)	0.392
Autonomic reactions	4	1.0	(0.0,	2.0)	1.0	(0.0,	3.0)	<0.001
Negative affect	8	5.0	(1.0,	11.0)	7.0	(2.0,	12.0)	0.121
Impaired Concentration	8	2.0	(0.0,	6.0)	4.0	(1.0,	10.0)	<0.001
Behavior change	5	2.0	(0.0,	6.5)	6.0	(1.5,	10.0)	<0.001
Arousal	5	1.0	(0.0,	4.0)	1.0	(0.0,	3.0)	<0.001
Control	6	0.0	(0.0,	1.0)	0.0	(0.0,	1.0)	0.004
Total MDQ Score	46	22.0	(12.0,	41.0)	34.0	(17.0,	52.5)	<0.001

Data are presented as medians (25th percentile, 75th percentile). [*]Wilcoxon signed rank test was used.

3.4 Symptoms of Eating Habit Before and During Menstruation

The prevalence rate of the symptoms of eating habits before menstruation was increased appetite (70.2%), craving for sweets (73.0%) and craving for snacks (51.1%). The rate during menstruation was increased appetite (56.7%), craving for sweets (71.6%) and craving for snacks (46.1%). All of the items had a higher prevalence before menstruation than during menstruation. The intensity of each symptom was significantly higher before menstruation than during menstruation (Table 5).

Table 5. Prevalence of eating habit symptoms before and during menstruation by the level of intensity and comparison of eating habit symptoms intensity before and during menstruation (n=141)

Menstrual phase	Symptoms	Intensity										Median (25th percentile, 75th percentile)	p-value[*]
		None		Mild		Moderate		Strong		Severe			
		n	%	n	%	n	%	n	%	n	%		
Before	Increased appetite	42	29.8	21	14.9	17	12.1	40	28.4	21	14.9	2.0 (0.0, 3.0)	Before vs during Increased appetite (p<0.001)
	Craving for sweets	38	27.0	27	19.1	24	17.0	32	22.7	20	14.2	2.0 (0.0, 3.0)	
	Craving for snacks	69	48.9	26	18.4	24	17.0	10	7.1	12	8.5	1.0 (0.0, 2.0)	Before vs during Craving for sweets (p=0.029)
During	Increased appetite	61	43.3	20	14.2	32	22.7	22	15.6	6	4.3	1.0 (0.0, 2.0)	
	Craving for sweets	40	28.4	32	22.7	30	21.3	28	19.9	11	7.8	1.0 (0.0, 3.0)	Before vs during Craving for snacks (p<0.001)
	Craving for snacks	76	53.9	28	19.9	24	17.0	5	3.5	8	5.7	0.0 (0.0, 2.0)	

[*]Wilcoxon signed rank test was used to compare the median of intensity of symptoms before and during menstruation.

4. Discussion

This study was conducted from May to July 2021, more than a year into the COVID-19 pandemic, thus it may affect a little to the survey results of the menstruation-related symptoms of university students in Japan. In our study, the prevalence rates of students who had experienced at least one symptom listed on the MDQ 46 items

before and during menstruation were 96.5% and 99.3%, respectively. The prevalence rate before menstruation was similar to the results of a previous study which used the MDQ 46 items (Matsumoto, Egawa, Kimura, & Hayashi, 2019). However, the prevalence rate during menstruation was higher than the result of a meta-analysis of prevalence for young women at 71.1% (Armour et al., 2019). Most of the students in the present study had symptoms during menstruation, but the number of symptoms or intensity of symptoms varied greatly depending on the individual. Some students may be diagnosed as PMS or dysmenorrhea.

Regarding intensity of the MDQ symptoms, it has been reported that among high school students, the MDQ total score and the scores of pain, water retention, impaired concentration, behavior change, autonomic reaction, and negative effect were lower in the premenstrual phase than in the menstrual phase (Otsuka-Ono, Sato, Ikeda, & Kamibeppu, 2015). Other studies have shown similar results for university students, as the MDQ total score and the scores of pain, autonomic reaction, impaired concentration, behavior change were lower in the premenstrual phase than in the menstrual phase (Ishihara, 2019; Uemura, Sakae, & Matsumura, 2014), but scores of negative affect and water retention were not different between the two phases (Ishihara, 2019). Our results were similar to a previous study conducted before the COVID-19 pandemic, which reported that the intensity of pain, autonomic reaction, impaired concentration, behavior change and MDQ total symptoms for young women may be stronger during menstruation than before menstruation.

We found that the ten most frequently experienced symptoms before menstruation were skin blemish or disorder, mood swings, irritability, swelling, cramps, fatigue, take naps, stay in bed, feeling sad or blue, weight gain and difficulty concentrating, which were most agreed with previous study (Matsumoto et al., 2019). Skin blemish, which was the most prevalent symptom in our study, may occur when sebum secretion increases due to increased progesterone secretion after ovulation. However, the prevalence rate of the skin disorder for university students varies greatly from 36% in Iran (Ghiasi, Keramat, & Mollaahmadi, 2018) to 80% for acne in Palestine (Abu Alwafa, Badrasawi, & Haj Hamad, 2021). Moreover, 56% of adults in USA reported that their acne got worse before menstruation (Geller, Rosen, Frankel, & Goldenberg, 2014), and 44% of adult women experienced premenstrual flares of their acne but this was not affected by ethnicity (Stoll et al., 2001). Thus, the difference in prevalence seems to depend on country-specific factors.

In our study, cramps, take naps, stay in bed, feeling sad or blue and difficulty concentrating were also common symptoms in the premenstrual phase. On the other hand, the cramps, take naps, stay in bed, feeling sad or blue, difficulty concentrating were not contained in the top ten of the most frequently experienced symptoms using the MDQ in previous research (Matsumoto et al., 2019). There was a significant increase in reported mental health symptoms including low mood, poor sleep, lowliness, poor concentration since the outbreak of the pandemic and the women who had these symptoms were more likely to have painful periods and worsening premenstrual symptom (Phelan et al., 2021). Therefore, according to our research results, the symptoms of lower abdominal pain, dozing, and difficulty concentrating may occur due to the worsening mental state caused by COVID-19.

Regarding symptoms during menstruation, previous studies mainly focused on the menstruation pain or dysmenorrhea, and there are less studies focusing on other menstruation related symptoms. We clarified the prevalence and intensity of the symptoms using MDQ and three eating items. Our results are consistent with previous studies in showing that the prevalence rate of cramps was as high as 79.2% (Yamamoto, Okazaki, Sakamoto, & Funatsu, 2009) and 86.5% (Ghiasi et al., 2018). Similarly, fatigue was reported as common as 84.5% (Ghiasi et al., 2018). Other studies also have reported prevalence rates of some other symptoms such as mood swings (71.8%), depression (62.7%) (Ghiasi et al., 2018) and irritability (76.3%) (Fernández-Martínez, Onieva-Zafra, Abreu-Sánchez, Fernández-Muñóz, & Parra-Fernández, 2019). Our results seem to show higher prevalence rates of mood swings and depression than the above studies. In a study conducted after the COVID-19 pandemic, 30% had new dysmenorrhea and increased psychological symptoms such as low mood, anxiety, lowliness during pandemic (Phelan et al., 2021). Because students have had to stay at home during the pandemic and cannot often communicate with others, this may influence the negative affect items, such as mood swings and depression.

Before the COVID-19 pandemic, we showed that the rate of increased consumption of sweets and snack in young students was 68.4% and 40%, respectively, before menstruation, and 47.9% and 23%, respectively, during menstruation (Matsuura et al., 2020). In the present study, which was conducted during the pandemic, we showed that the prevalence rate of the increased appetite and craving for sweets before menstruation was higher than the MDQ 46 symptoms, and that the rate of the craving for sweets during menstruation was the fifth most prevalent symptom. A study in UAE showed that 71% of university students had a craving for sweets and 72% had increased appetite (Hashim et al., 2019). Moreover, the marked change in appetite, over-eating, or specific food craving is

one of the diagnoses of PMDD (American Psychiatric Association, 2013), and these changing eating habits are common in the premenstrual phase. In our previous study, we also found that increased appetite and intake of sweets are associated with depression, anger and sleepiness before menstruation, while intake of junk food such as snacks is associated with irritability and depression (Matsuura et al., 2020). These symptoms of eating behavior may be associated with psychological symptoms caused by COVID-19 pandemic.

The premenstrual symptoms and dysmenorrhea are reported to affect school life and academic performance (Armour et al., 2019; Tadakawa et al., 2016). Recently, it has been reported that dysmenorrhea increases the risk of hypertensive disorders of pregnancy (Nakayama et al., 2020) and increases the risk of giving birth to a low-birth-weight baby (Feng et al., 2021), while PMS increases the risk of hypertension (Bertone-Johnson, Whitcomb, Rich-Edwards, Hankinson, & Manson, 2015). Thus, dysmenorrhea and PMS may influence the future health of young women. It implies that we should advise young students to visit the medical doctors in order to receive appropriate treatments.

This study has several limitations. First, the participants were limited to a department in a university and the sample size was small, which makes generalization of these results difficult. Second, the participants may have recall bias in describing their own experiences of menstruation symptoms. Third, the causal relationships with COVID -19 pandemic and menstruation related symptoms cannot be evaluated since this was a cross-sectional survey. A longitudinal study may be needed to study the changes of menstruation-related symptoms by using MDQ in other areas or in participants with different backgrounds.

5. Conclusion

In this study, which was conducted during the time of the COVID-19 pandemic, using the MDQ we found that scores of pain, autonomic reaction, impaired concentration, behavior change, and control were significantly higher during the menstruation phase compared to the scores of pre-menstruation phase. It may suggest that the exposure to the COVID-19 pandemic may affect more psychological symptoms rather than the physical symptoms.

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Competing Interests Statement

The authors declare that there are no competing conflicts of interest.

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