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Menstrual Cycle Characteristics, Premenstrual Syndrome, and Anxiety in Midwifery Student Infected and Not Infected with COVID-19: A Comparative Study

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Abstract

Objective: Periods of crisis, fear, and stress target hypothalamic-gonadal axis of women in reproductive age and can have an impact on menstrual symptoms. This study was conducted to evaluate menstrual cycle, premenstrual syndrome and anxiety in midwifery students with or without COVID-19 disease.

Methods: In this descriptive and comparative study, 216 young girls infected with COVID-19 in the last 6 months were compared with 634 midwifery students, who were not infected yet. "Personal Description Form", "Premenstrual Syndrome Scale (PMSS)" and "State-Trait Anxiety Inventory (STAI)" were used to collect data.

Results: In the study, it was determined that the mean scores of PMSS and STAI of midwifery students, who had COVID-19 disease were higher than those who did not. It was determined that the difference between the mean scores of PMSS and STAI of midwifery students had COVID-19 was statistically significant, while the difference between the mean scores of PMSS and STAI of midwifery students who did not have COVID-19 disease was not statistically significant. The difference between the prolongation of the two cycle intervals and the reduction of menstrual bleeding in midwifery students with and without COVID-19 disease was found to be statistically significant.

Conclusion: The difference between the prolongation of the two cycle intervals and the reduction of menstrual bleeding in midwifery students with and without COVID-19 disease was found to be statistically significant. In addition, the study revealed that being diagnosed with COVID-19 increased the premenstrual symptoms and anxiety levels of single young girls.

Key words: Midwifery students, COVID-19, Premenstrual syndrome, Anxiety, Menstrual period, Menstrual irregularit

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INTRODUCTION

It has been reported that COVID-19 can negatively affect sexual and reproductive health (1), and women will be affected more by these issues in the long term (2). The angiotensin-converting enzyme-2 (ACE2) receptor, which is recognized as the specific receptor of the SARS-CoV-2 virus (3), was also seen in ovarian granulosa cells in an animal study (4). This suggests that the ovaries may be targeted by SARS-CoV-2 (4). ACE2 is found in the uterus and ovaries, which are vitally important for a healthy menstrual cycle (5). The menstrual cycle involves complicated interactions among various tissues, hormones, and organ systems (6). Many women of reproductive age experience one or multiple emotional or physical changes before their menstrual period or during menstrual bleeding (7). Physiological and psychological changes observed prior to the menstrual period are defined as Premenstrual Syndrome (PMS). PMS affects the activities of daily living and social performance of women and leads to mood disorders. PMS also causes serious complications related to mood disorders (8).

Since the onset of the COVID-19 pandemic, there have been debates on social media and blogs that demonstrate menstrual changes, including the duration, frequency, and volume (more severe bleeding and coagulation) of women's menstrual period, increased dysmenorrhea, and exacerbating PMS (9). Although the menstrual cycles of women who have contracted COVID-19 are reported to be regular, it was stated that COVID-19 has a potentially harmful effect on ovarian reserves and endocrine functions (10).

COVID-19 not only creates negative effects on various systems (5) but also leads to loneliness, social isolation, and financial pressure, thus significantly affecting the mental health of many individuals. It was stated that the fear and anxiety of being infected by COVID-19 led to uncertainty and increases in psychological problems are observed the most in young individuals between the ages of 18 and 24, as well as women (11). It was determined that the increase in anxiety and stress levels associated with the COVID-19 pandemic is significant enough to affect the characteristics of the menstrual cycle (12). Periods of crisis, fear, and stress target the hypothalamic-gonadal axis of women of reproductive age and can have an impact on menstrual symptoms (5,13,14). This situation can result in functional hypothalamic amenorrhea and chronic anovulation, which do not originate from any underlying organic cause (11). While irregular and prolonged menstrual cycles are associated with early death risk, amenorrhea can be an indicator of reduced fertility that may be associated with chronic diseases (9).

It is believed that reproductive health in this pandemic period is an important issue that should not be neglected. A limited number of studies examining changes in women's menstrual cycles in the pandemic period were encountered in the literature (4,6,10,12). Accordingly, the aim of this study was to identify different symptoms and changes in menstrual cycles in the pandemic period experienced by young women who were infected and those who were not infected with COVID-19 and determine their PMS and anxiety levels. Considering the importance of the menstrual cycle for women, it is thought that the study will significantly contribute to healthcare professionals in their evaluation of menstrual cycle changes in the pandemic period in young women who were infected with COVID-19.

METHODS

Research and design

This descriptive and comparative study was carried out between December 2021 and January 2022. The participants were selected by using the virtual snowball (chain-referral) sampling method, which is a purposive sampling method. The data were collected via Google Forms by using the online self-report method. The population of the study consisted of approximately 10,000 students studying in the Midwifery Department of a university in Turkey in the spring semester of the 2020-2021 academic year (15). As a result of the power analysis that was performed, the minimum required sample size was calculated as 623 participants with a 0.05 margin of error, at an 80% representative power, and in a 99% confidence interval, and the study was completed with 850 participants. In the study, the data of 216 young women infected with COVID-19 within the last 6 months were compared to those of 634 young women who had not been infected with COVID-19 (n=850).

Inclusion Criteria

- ✓ Being unmarried,
- ✓ Being between 18 and 25 years of age,
- ✓ Having a regular menstrual cycle.

Exclusion Criteria

- ✓ Using contraceptive pills,
- ✓ Not responding to research questions.

Data Collection Tools

The data were collected using an "Identifying Information Form", the "Premenstrual Syndrome Scale", and the "State Anxiety Inventory."

Identifying Information Form

The form that was prepared by the researchers by reviewing the relevant literature (6,12,16) consisted of 28 questions inquiring about the participants' sociodemographic characteristics, as well as their menstrual characteristics.

Premenstrual Syndrome Scale (PMSS)

The reliability and validity study of the scale was carried out by Gencdogan in 2006. The scale, which is used to determine premenstrual symptoms and severity, is a 5-point Likert-type scale consisting of 44 items. The scale has nine subscales, which are depressive mood, anxiety, anger, exhaustion, depressive thoughts, pain, appetite changes, and abdominal bloating. The minimum and maximum total scores on the scale are 44 and 220. A high score is indicative of intense premenstrual symptoms. The Cronbach's alpha coefficient of the scale was reported as 0.750 (17). In this study, the Cronbach's alpha coefficient was determined as 0.975.

State Anxiety Inventory (STAI-I)

The Turkish validity and reliability study of the State Anxiety Inventory, developed by Spielberger et al. in 1970 as a part of the State-Trait Anxiety Inventory, was conducted by Oner and Le Compte in 1985. It includes statements that measure how the individual feels at a given moment. The 20-item inventory with a 4-point scoring system has 10 negative and 10 positive statements. The negative statements are scored as "not at all = 1", "somewhat = 2", "moderately = 3", and "very much so = 4". The positive statements, on the other hand, are inversely scored. The minimum and maximum scores to be obtained from the inventory are 20 and 80. Higher scores indicate higher levels of anxiety As a result of the validity and reliability studies conducted while adapting the inventory to Turkish, the scale was found to be reliable. Additionally, as a result of the reliability study carried out by the researcher, the

scale' internal consistency coefficient was found to be 0.870, and the scale was considered reliable (18). In this study, the internal consistency coefficient of the scale was determined as 0.905.

Data Collection

The data collection tools were prepared on the Google Forms platform. The form started with a question inquiring whether the participants voluntarily agreed to participate in the study. The first part of the form included the Identifying Information Form, the second part consisted of PMSS, and the third part included STAI-I. Later, the form was sent online through WhatsApp and Instagram to with midwifery students in the age group of 18-25 who agreed to participate in the study. It took about 10 minutes to fill out the form

Statistical Analysis

The normal distribution of the data was checked using the Kolmogorov-Smirnov test. As it was found that the skewness value of the model was between -2 and +2, it was determined that the data met normality assumptions (19). The data were analyzed by creating a dataset in the IBM SPSS Statistics for Windows Version 25.0 package software. In the statistical analysis, mean, percentage, standard deviation, Chi-squared test, independent-samples t-test, and correlation analysis were used. In the interpretation of the results, the level of statistical significance was accepted as $p<0.05$.

RESULTS

The descriptive characteristics of the midwifery students who were included in the study are presented in Table 1. The mean age of the participants was 20.35±3.05, 43.3% were first-year students, 94.2% were unemployed, the mothers of 90.5% were unemployed, the fathers of 68.4% were employed, 65.5% had a moderate level of income, 75.2% had nuclear families, 89.5% were non-smokers, 76.1% did not have boyfriends, and their mean BMI value was 21.44±3.49. It was also found that 85.9% of the participants did not experience a change in the numbers of their bleeding days in the pandemic period, the period between two consecutive cycles was prolonged among 14.6% of them, it was sometimes prolonged in 15.4%, menstrual bleeding increased in 16.9%, menstrual bleeding decreased in 17.5%, menstrual pain increased in 33.1%, the number of hygienic pads used per day increased in 22.3%, and the number of pads per day decreased in 6.8% (Table 1).

The minimum and maximum scores to be obtained from the total STAI-I and PMSS and the subscales of PMSS, and the mean scores of the participants are presented in Table 3. Among the participants, those who had been infected with COVID-19 had mean scores of 22.69±7.23 in the depressive mood subscale, 17.58±7.35 in the anxiety subscale19.75±6.19 in the fatigue subscale, 15.41±5.60 in the irritability subscale, 18.77±7.25 in the depressive thoughts subscale, 8.89±3.23 in the pain subscale, 8.64±3.57 in the appetite changes subscale, 8.57±3.04 in the sleep changes subscale, 8.58±3.66 in the abdominal bloating subscale, and 135.46±33.47 in the overall PMSS, whereas their mean total STAI-I score was 47.21±9.11. The participants who had not been infected with COVID-19 had mean scores of 22.54±7.15 in the depressive mood subscale, 17.58±6.66 in the anxiety subscale, 19.36±5.93 in the exhaustion subscale, 15.12±5.28 in the anger subscale, 18.88±7.16 in the depressive

Table 1. Descriptive characteristics of young girls participating in the study

Variable	**Mean ± (SD)**	
Age (years)	20.35±3.05	
BMI (kg/weight^2)	21.44±3.49	
Age of Menarche (years)	13.40±1.51	
Menstrual Bleeding time	5.93±1.47	
Cycle duration (days)	28.36±5.47	
	n	**%**
Class		
1	368	43.3
2	136	16.0
3	153	18.0
4	194	22.8
Mother's educational status		
Primary school	590	69.4
Middle School	137	16.1
High school	87	10.2
University and above	37	4.3
Working status		
Working	49	5.8
Not working	801	94.2
Mother's working status		
Working	81	9.5
Not working	769	90.5
Father's working status		
Working	581	68.4
Not working	269	31.6
Income status		
Low	278	32.7
Middle	557	65.5
High	15	1.8
Living place		
Province	461	54.2
District	221	26.0
Village-Town	168	18.8
Family structure		
Core	639	75.2
Traditional	182	21.4
Broken	29	3.4
Smoking status		
Yes	89	10.5
No	761	89.5
Status of having a boyfriend		
Yes	203	23.9
No	647	76.1
Has your menstrual period decreased during the pandemic period?		
Yes	52	6.1
No	730	85.9
Sometimes	68	8.0
Has your two-cycle interval been extended during the pandemic period?		
Yes	124	14.6
No	595	70.0
Sometimes	131	15.4
Did your menstrual bleeding increase during the pandemic period?		
Yes before	53	6.2
Yes in the middle	66	7.8
Yes after	25	2.9
No it hasn't changed	706	83.1
Did your menstrual bleeding decrease during the pandemic period?		
Yes before	30	3.5
Yes in the middle	53	6.2
Yes after	66	7.8
No it hasn't changed	701	82.5
Did your pain increase during the menstrual bleeding during the pandemic period?		
Yes before	154	18.1
Yes in the middle	138	16.2
Yes after	15	1.8
No it hasn't changed	543	63.9
Did the number of pads you use daily increase during the pandemic period?		
Yes	190	22.3
No	660	77.7
Has the number of pads you use daily decreased during the pandemic period?		
Yes	58	6.8
No	792	93.2
Total 850 100		

SD = Standard Deviation

thoughts subscale, 8.89±3.18 in the pain subscale, 8.80±3.39 in the appetite changes subscale, 8.50±3.15 in the sleep changes subscale, 8.59±3.57 in the abdominal bloating subscale, and 128.31±37.38 in the overall PMSS, whereas their mean total STAI-I score was 41.88±9.83 (Table 2).

The results of the comparison of the participants who had been infected with COVID-19 and those who had not been infected with COVID-19 according to their menstrual cycle characteristics are presented in Table 3. It was determined that the two groups had significantly different rates of having a prolonged interval between two consecutive cycles and experiencing a decrease in menstrual bleeding (respectively, p=0.037 and p=0.047), while the differences between the groups in terms of the presence of PMS and increase in menstrual bleeding, increase in pain in the menstruation period, and increase or decrease in the numbers of pads used per day were not statistically significant (p>0.05) (Table 3). The results of the comparison of the mean scale scores of the participants who had been infected with COVID-19 and those who had not been infected with COVID-19 are presented in Table 4. According to these results, the differences between the PMSS and STAI-I scores of the two groups were statistically significant (p<0.05) (Table 4).

Table 2. The lowest and highest scores that can be taken from the total and sub-dimensions of the scale and the average scores of the young girls participating in the study

		Infected with COVID-19 (n=216)		Not infected with COVID-19 (n=634)	
Variables	**Min-Max that can be taken**	**X ±SD**	**Received min/max points**	**X ±SD**	**Received min/max points**
Depressive affect	7-35	22.69±7.23	7-35	22.54±7.15	7-35
Anxiety	7-35	17.58±7.35	7-35	17.58±6.66	7-35
Fatigue	6-30	19.75±6.19	6-30	19.36±5.93	6-30
Irritability	5-25	15.41±5.60	5-25	15.12±5.28	5-25
Depressive thoughts	7-35	18.77±7.25	7-35	18.88±7.16	7-35
Pain	3-15	8.89±3.23	3-15	8.89±3.18	3-15
Appetite changes	3-15	8.64±3.57	3-15	8.80±3.39	3-15
Sleep changes	3-15	8.57±3.04	3-15	8.50±3.15	3-15
Swelling	3-15	8.58±3.66	3-15	8.59±3.57	3-15
PMSS total	44-220	135.46±33.4	46-216	128.31±37.38	44-220
STAI total	20-80	47.21±9.11	22-75	41.88±9.83	20-80

PMSS; Premenstrual Syndrome Scale, STAI: State Anxiety İnventory, SD = Standard Deviation

Table 3. Comparison of young girls infected and not infected COVID-19 disease according to menstrual cycle characteristics (n=850)

	Infected with COVID-19 (n=216)		Not infected with COVID-19 (n=634)		
Menstrual Cycle Characteristics	**n**	**%**	**n**	**%**	**Test and p value**
Two-Cycle ınterval ıncrease situation					
Yes	41	19.0	83	13.1	X^2=6.612
No	83	69.4	445	70.2	**p=.037**
Sometimes	124	11.6	106	16.7	
Menstrual bleeding ıncrease status					
Yes at the beginning	10	7.4	20	5.8	X^2=2.924
Yes in the middle	20	8.8	33	7.4	p=.404
Yes finally	21	4.2	46	2.6	
No it hasn't changed	165	79.6	536	84.2	
Menstrual bleeding decrease status					
Yes at the beginning	10	4.6	20	3.2	X^2=7.96
Yes in the middle	20	9.3	33	5.2	**p=.047**
Yes finally	21	9.7	45	7.1	
No it hasn't changed	165	76.4	536	84.5	
Increase in pain in the menstruation period					
Yes at the beginning	44	20.4	110	18.1	
Yes in the middle	38	17.6	100	16.2	X^2=2.645
Yes finally	2	0.9	13	1.8	p=.450
No it hasn't changed	132	61.1	411	63.9	
Has your daily pad number increased?					
Yes	51	23.6	139	21.9	X^2=.264
No	165	76.4	495	78.1	p=.335
Has your daily pads decreased?					
Yes	19	8.8	139	6.2	X^2=1.773
No	197	91.2	495	93.8	p=.183

X^2: Pearson chi-square test

Table 4. Comparison of the mean scores obtained from the scales of young girls infected and not infected COVID-19 disease

Scales	İnfected with COVID-19 (n=216)	Not infected with COVID-19 (n=634)	Test and p value
PMSS Total	135.52±33.47	128.31±37.38	t=2.513 **p=.012**
STAI Total	47.21±9.11	41.88±9.83	t=7.282 **p<.001**

PMSS; Premenstrual Syndrome Scale, STAI: State Anxiety İnventory

DISCUSSION

In this study, in which premenstrual cycle characteristics, premenstrual syndrome characteristics, and anxiety levels of unmarried midwifery students in the age range of 18-25 who had regular menstrual cycles in the pre-pandemic period were analyzed, more than one-fourth (25.4%) of the participants were found to consist of those who had been infected with COVID-19. The results of this study revealed that being infected with COVID-19 changed the menstrual cycle characteristics of the participants, and it significantly increased their PMS and anxiety levels.

There are various types of viruses (e.g., HIV, HCV) that affect the menstrual cycle (20-22). However, the effects of the virus causing COVID-19 (SARS-CoV-2) on the menstrual cycle are not clear (4). Nevertheless, COVID-19 has physical and psychological impacts on individuals, and menstruation is negatively affected by external factors such as infections, medicinal treatments, and the stress that is experienced (4,12,23). In this study, it was determined that intervals between two consecutive cycles increased while menstrual bleeding decreased in the participants who had been infected with COVID-19 (respectively, p=.037 and p=.047) (Table 3). In a similar study conducted to investigate the effects of SARS-CoV-2 infection on the menstrual cycles of 237 women of reproductive age who had been infected with COVID-19, it was found that the menstrual cycle intervals of one-fifth of the women increased, and menstrual bleeding decreased in 20% of them (4). Similarly, in a study in which women who had been infected with COVID-19 on severe and moderate levels were compared to determine the relationship between COVID-19 and ovarian function, it was found that menstrual irregularity and amenorrhea were observed more in the women who had severe COVID-19 in comparison to those who had moderate COVID-19 (10). In a prospective study conducted by Khan et al. on women infected with COVID-19 to determine the relationship between SARS-CoV-2 infection and changes in the menstrual cycle, it was determined that women experienced changes in their menstrual cycles in the post-COVID-19 period, and they menstruated less frequently. Additionally, it was found that those who experienced more COVID-19 symptoms had more changes in their menstrual cycles (6). These findings demonstrated that contracting COVID-19 can affect the menstrual cycle and supported the findings of this study. In a study conducted on women in the age group of 18-45 who had regular menstrual cycles in the pre-pandemic period regardless of their previous COVID-19 infection status, the women were found to have used fewer pads in their menstrual period in the COVID-19 pandemic period in comparison to the number of pads they used in the pre-pandemic period, which showed that their menstrual bleeding frequencies decreased (12).

In this study, it was found that the participants who had experienced COVID-19 infection had

significantly higher total PMSS scores compared to those who had not been infected with COVID-19 and having been infected with COVID-19 significantly increased PMS levels ($p<0.05$) (Table 4). Previous research has supported the finding of this study, and it was determined that viral infections could increase the severity of menstrual symptoms such as PMS by affecting the individual's immune system (9,24). Khan et al. determined an increase in the PMS symptoms of women who had been infected with COVID-19 in the post-COVID-19 period (6). In a study conducted by Davis et al. to determine the long-term effects of COVID-19, it was determined that more than one-third of the participating women experienced increases in symptoms before and during menstruation (25). Similar results have been obtained in studies that were carried out to determine the relationship between different infections and PMS (24,26). In a study conducted on 865 women infected with COVID-19 to determine the effects of sexually transmitted diseases on PMS, the presence of infection was determined to increase PMS (24). In a similar study conducted by Doyle et al. to determine the relationship between sexually transmitted diseases and PMS, it was observed that the presence of bacterial or viral infections increased PMS symptoms (26). These results showed that contracting COVID-19 can increase PMS, which supported the findings of this study.

In this study, the mean STAI-I score of the participants who had been infected with COVID-19 was higher compared to the mean score of those who had not been infected with COVID-19, and having been infected with COVID-19 significantly increased anxiety levels ($p<0.05$) (Table 4). Similar to the finding of this study, in a study conducted to identify the anxiety levels of individuals in the COVID-19 pandemic period, the anxiety levels of those who had been COVID-19-positive were found to be higher in comparison to those who had not contracted the disease (27). Additionally, in a study in which 34 studies with up to 3 months of follow-up periods following the diagnosis of COVID-19 were examined to determine physical and mental health complications after COVID-19 infection, it was found that individuals commonly experienced anxiety in the post-COVID-19 period (28). These results supported the finding of this study, and they showed that having COVID-19 may increase anxiety.

Limitations

This study had some significant limitations. Firstly, the data were collected through self-reports. Another important limitation was that as self-reporting menstrual cycles may pose a measurement error, the data collected in this study were based on self-reports which were subject to prejudices. Besides, the factors investigated in the study (menstruation characteristics, PMS, anxiety) can vary in time. Although a retrospective approach was suitable for this study, a prospective or longitudinal approach can be adopted in future studies. Finally, though the study was based on a probabilistic sampling method, the data were collected from university students within a certain age range in Turkey. Therefore, the results cannot be generalized to all midwifery students. On the other hand, the study presents solid evidence regarding the evaluation of menstrual cycle characteristics, premenstrual syndrome, and anxiety in midwifery students who had been infected with COVID-19 and those who had not been infected with COVID-19. The strength of our study was the number of participants. Another

strong point was that there is no other study comparing midwifery students infected and not infected with COVID-19 in terms of PMS characteristics.

CONCLUSIONS

The results of this study revealed that having been infected with COVID-19 affected the menstruation characteristics of the unmarried midwifery students who participated in the study, increased their menstrual cycle intervals, and decreased their menstrual bleeding. Moreover, it was determined that having been infected with COVID-19 the premenstrual symptoms and anxiety levels of the participants. Diagnosing risk factors and applying the necessary physical and psychological midwifery approaches is rather important so that the menstrual cycle, which is accepted as a physical and psychological process, does not lose its normal characteristics. It is recommended to follow up midwifery students infected with COVID-19 and those who have menstrual anomalies and PMS symptoms at home to prevent both waste of medical resources and hospital infections. It is also recommended to plan and implement future studies to determine whether menstrual cycle parameters and PMS levels will return to their normal course after the pandemic period is over. Furthermore, psycho-educational interventions are recommended to lower the anxiety levels of midwifery students infected with COVID-19.

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Ethics Committee Approval: Ethical approval for the study was obtained from Inonu University Medical Sciences Scientific Research and Publication Ethics Committee (Decision No: 2021/2871). The participants were informed about the study, and voluntary participants were included in the study after they gave their consent on the Google Forms document.

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