










Original Research

Menstrual symptoms variation among Lebanese women before and after the COVID-19 pandemic

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Abstract

Objectives: Pandemic diseases and the confinement measures due to COVID-19 infection have introduced acute and persistent psychosocial stressors for different individuals with a greater influence on females manifested through changes in the menstrual cycle. The objective of this study was to assess Lebanese female of reproductive age about their menstrual cycle, their mental health, and their lifestyle, throughout the COVID-19 pandemic, Beirut blast, and the economic crises. **Methods:** A cross-sectional online study conducted between October and December 2021, enrolled 398 Lebanese women using the snowball technique. The Menstrual Symptom Questionnaire (MSQ) was used to assess menstrual symptoms. A repeated measures ANOVA was used to assess factors associated with the variation in MSQ scores after vs before the pandemic. **Results:** Our results showed that a significantly higher number of days of menses, number of pads per day and total MSQ score were significantly found after the pandemic compared to before it. More distress (Beta=0.68), more post-traumatic stress disorder due to COVID-19 (Beta=0.19), a higher number of waterpipes smoked per week (Beta=1.20) and being infected by COVID-19 compared to not (Beta=3.98) were significantly associated with an increase in the MSQ score after the pandemic compared to before it. **Conclusion:** Our main findings indicate that females had irregular menstrual cycles, unpredictable bleeding pattern, and intense symptoms severity post COVID-19 pandemic. Furthermore, stress post COVID-19 and Beirut blast tended to be associated with increased menstrual symptoms. Thus, vulnerable women should be identified and offered appropriate care, information, and awareness regarding their menstrual period during a pandemic.

Keywords: women; COVID-19; menstrual cycle; bleeding; distress; Lebanon

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INTRODUCTION

From ancient times, people tended to define menstruation. The definition varied from being an excess of blood eliminated from the body within lunar months interval, supported by Aristotle, to being defined as the shedding of the endometrium.¹ A normal menstrual cycle is the regular recurrence of menses each month; it is the time calculated from the first day of menses till the beginning of the next cycle, corresponding to approximately 28 days in healthy fertile women.^{1,2}

Many dysfunctions and irregularities, known as menstrual symptoms, can alter the menstrual cycle. They are classified into menstrual related diagnosis and premenstrual symptoms (PMS).³ The symptoms that occur in the context of PMS are not specific for this syndrome, however, the timing of occurrence is what defines the PMS.⁴ They can appear up to two weeks before menses and terminate after the beginning of the menstrual



period.⁵ The symptoms include physical and emotional complaints (abdominal bloating, painful breasts, skin disorders, depression, tension, mood swings, headache, loss of energy, backache, fatigue, etc.).⁴⁻⁶ The menstrual related symptoms can be identified as dysmenorrhea (abdominal cramps during menstruation), hypermenorrhea (bleeding volume of more than 80 ml or bleeding duration lasting for more than 7 days), hypomenorrhea (bleeding period of fewer than 3 days or a bleeding volume less than 30 ml),⁷ polymenorrhea (cycle less than 21 days) or oligomenorrhea (cycle greater than 35 days).^{8,9}

The menstrual cycle is regulated by a cascade of hormones; any effect on this cycle either from some factors or stressors can result in menstrual irregularities. Several studies expressed a relation between menstrual symptoms and psychiatric problems in healthy women. By way of illustration, numerous studies examined the relation between stress and menstrual cycle characteristics, some data demonstrated the alteration of menstrual function with high-stress levels^{10,11} while others associated stress with increased risk of heavy menstrual bleeding and influencing bleed duration¹² or affecting cycle length.^{13,14} However, others declined the presence of a relation between stress and menstrual duration, flow, or even pain.¹⁵ Furthermore, in post-traumatic stress disorder (PTSD), evidence indicated an elevation of menstrual fluctuations, and menstrual dysphoric disorder (severe menstrual fluctuations).¹⁶ On top of that, studies demonstrated that females with depression experienced PMS compared to those who were never mentally ill.^{17,18} Depression was found to increase the likelihood of dysmenorrhea in adolescent females; however, anxiety levels had a controversial result. Some studies denied the correlation of anxiety levels to the occurrence of dysmenorrhea.¹⁹ while others, demonstrated the positive effect of anxiety upon menstrual symptoms.¹⁹ Additionally, a relation between smoking and menstrual symptoms could be established. It was shown that adolescent smokers describe having more menstrual symptoms than non-smokers.^{19,20} Certainly, the more the number of cigarettes and the younger the age of smoking, the higher the risk of menstrual symptoms.²⁰ Further, with all these assessments about fluctuation in menstrual symptoms, researchers found that obesity and high BMI scores were also one of the leading causes of menstrual irregularities and higher PMS^{21,22} and weight reduction can alleviate these disturbances.²³ To add on all this, the socioeconomic status, can influence the reproductive cycle. For instance, low educational level²⁴ or high-income levels were significantly correlated to irregular menstruation.^{24,25} Lastly, studies suggested that the number of comorbidities was directly related to PMS; however, it was not associated with dysmenorrhea.²⁶

In December 2019, a novel coronavirus emerged in China and spread rapidly in the world. The virus itself and the strict health measures taken by the government influenced the population's mental health. Depression presents as part of adjustment disorder and is more prone to develop during the quarantine period.²⁷ Anxiety and stress increase as well, because of fear of getting infected by the virus.²⁸ Consequently, COVID-19 can be related to menstrual irregularities and many researchers worked on eliciting this correlation.^{29,30} For instance, a study performed

by Gonca Buran showed that female complained an increase in dysmenorrhea compared to before covid.³¹ Additionally, an increase in menstrual symptoms was demonstrated with the increase of women's fear of COVID-19.³¹ Other studies showed similar relation, where women experienced changes in their menstrual cycle and menstrual symptoms during the lockdown.³² Demir et al, expressed in their study a decrease in the number of pads and duration of period with an increase in menstrual symptoms following COVID-19 pandemic.

Not only the pandemic affected women's health but also the infection by the virus itself. In a study conducted in China, COVID-19 female participants had menstrual volume changes mainly a decrease, and a cycle prolongation.³³ Other studies found that levels of dysmenorrhea were higher in women infected by COVID-19 virus.³⁴

To bring under control the rising number of infected cases, vaccines were developed; and many women have noticed changes in their menstrual cycles (menorrhagia, metrorrhagia, polymenorrhea) after getting vaccinated; however, there is limited data about this affirmation.³⁵ A US cohort study on reproductive females showed no changes in the duration of menses with a minor variation in cycle length having no clinical concern.³⁶

The menstrual cycle is important in the life of every woman; it is a sign of fertility and health. Menstrual symptoms and cycle variability are present and vary from cycle to cycle. However, COVID-19 cases are increasing and the number of vaccinated people is similarly increasing, so these menstrual variabilities are seen to be concerning, especially in the Lebanese community where anxiety and depression are in a constant increase not only due to COVID-19, but also due to the economic crises (banking system collapse, the country is on the verge of bankruptcy, increasing unemployment...) that Lebanon was living during the pandemic and to the massive Beirut port blast, on 4 august 2020, that left the city destroyed and people dead, injured, and homeless.^{37,38}

To our knowledge, the effect of the COVID-19 pandemic in Lebanon on menstrual symptoms has received little attention. Since COVID-19 increased, it is crucial to assess its relation on menstrual symptoms. Thus, the objective of our study was to assess Lebanese female of reproductive age about their menstrual cycle, their mental health, and their lifestyle, throughout the COVID-19 pandemic, Beirut blast, and the economic crises.

METHODS

Study design and participants

This cross-sectional study was conducted between October and December 2021, after which Lebanon was in a state of health emergency and a complete lockdown was imposed to halt the progression of COVID-19 pandemic. A total of 398 participants was recruited from the Lebanese population based on a snowball sampling technique. Data collection was carried out through filling out an anonymous online self-



administered questionnaire available in Arabic. All participants were aware of the general purpose of the study and gave prior informed consent. Participation in this study was voluntary and no incentive was given to the participants. A pilot test was conducted on 10 persons to check the clarity of the questionnaire and the feasibility of the study. Of note, that these 10 questionnaires related data were not entered in the final database.

Questionnaire and variables

The questionnaire assessed demographic, menses history, and potential exposure to SARS-CoV-2 virus of participants. The first page of the questionnaire included an explanation of the study topic and objective and a statement ensuring the anonymity of respondents. The demographic part of the questionnaire addressed the following variables: age, gender, body mass index, and previous history of medical conditions. In addition, house crowding index was measured by dividing the number of persons living in the household by the number of rooms, excluding bathrooms and kitchen, to assess socioeconomic status.³⁹ Also, the questionnaire assessed health questions regarding the personal history of menses before and after COVID pandemic reflected by the menstrual pain, number of pads used per day, number of days of menses, and number of days of bleeding.

Also, the questionnaire used the following scales:

Menstrual Symptom Questionnaire (MSQ): It is a 24-item self-report measure which assesses menstrual pain and symptoms (e.g., 'I have cramps that begin on the first day of my period'; 'I feel depressed for several days before my period').⁴⁰ The score on each item ranges from 1 (never) to 5 (always) with a higher composite score indicating more symptoms (Cronbach's alpha=0.914).

Post-traumatic Stress Disorder Checklist (PCL-C): The PCL-C is a summated rating scale that gives a continuous measure of PTSD (Post Traumatic Stress Disorder) symptom severity with scores ranging from 17 to 85.⁴¹ Participants are asked how much of a 5-point scale (ranging from 1 = not at all to 5 = extremely) they have been distressed by each PTSD symptom over the past month. A higher score suggests more severe symptoms of PTSD. The total score was then categorized into four categories: no severity (scores between 17 and 29), some PTSD symptoms (scores 28-29), moderate to moderately high severity (scores between 30 and 44), and high severity (scores between 45 and 85). This scale was assessed after Beirut blast and the COVID-19 pandemic (Cronbach's alpha=0.935 for the Beirut blast and 0.959 for the COVID pandemic).

Lebanese Anxiety Scale (LAS): is a 10-item scale which includes elements about anxiety symptoms experienced during the past week (including the interview day). Higher scores indicate higher anxiety (Cronbach's alpha=0.881).^{42,43}

Patient Health Questionnaire- 9 items (PHQ-9): Validated in Lebanon, it is a 9-item self-reported scale, which evaluates depression in adults during the last 2 weeks. Higher scores indicating higher depression (Cronbach's alpha=0.913).⁴⁴

Beirut Distress Scale (BDS): Validated in Lebanon, it is a 10-item scale used to assess mental and psychological distress. Answers were recorded on a 4-point Likert scale from 0 (never) to 3 (very much), with higher scores indicating higher stress (Cronbach's alpha=0.903).⁴⁵

Statistical analysis

The SPSS software version 23 was used to conduct data analysis. Cronbach's alpha values were computed for all scales. The normal distribution was verified and confirmed; therefore, parametric tests were used during the analysis. To compare continuous variables before and after COVID, the paired sample T test was used, whereas the repeated measures ANOVA was used to check the factors associated with the change in the MSQ score after vs before the pandemic. All variables that showed a $p < 0.25$ in the bivariate analysis were considered important variables to be entered in the model in order to eliminate potentially confounding factors as much as possible.⁴⁶ A value of $p < 0.05$ was considered significant.

RESULTS

A total of 398 participants filled the survey (mean age: 23.67 ± 6.50 years). All details about the sample are summarized in Table 1.

Comparison of menstrual symptoms before and after the pandemic

A significantly higher number of days of menses, number of

Variable	N (%)
Cigarette smoking (yes)	37 (9.3%)
Waterpipe smoking (yes)	149 (37.4%)
Infection by COVID-19 (yes)	152 (38.2%)
COVID-19 vaccine administered (yes)	249 (62.6%)
Gastro-intestinal problems (yes)	43 (10.8%)
Cardiac problems (yes)	11 (2.8%)
Hypertension (yes)	7 (1.8%)
Respiratory problems (yes)	37 (9.3%)
Diabetes (yes)	8 (2.0%)
Head trauma (yes)	19 (4.8%)
Dyslipidemia (yes)	10 (2.5%)
Cancer (yes)	5 (1.3%)
Thyroid problems (yes)	18 (4.5%)
Psychiatric problems (yes)	20 (5.0%)
Neurological problems (yes)	8 (2.0%)
	Mean ± SD
Age (in years)	23.67 ± 6.50
Body Mass Index (kg/m ²)	23.11 ± 4.34
Household crowding index	1.33 ± 0.79
Number of comorbidities	0.47 ± 1.19



Variable	Before the pandemic	After the pandemic	t	p
Number of days of menses	26.39 ± 5.25	18.95 ± 9.44	-13.71	<0.001
Number of days of bleeding	5.04 ± 2.02	5.10 ± 1.99	-0.99	0.323
Number of pads per day	4.55 ± 2.14	4.81 ± 3.01	-2.35	0.019
Pain severity	6.29 ± 2.49	6.38 ± 2.64	-1.26	0.210
Total MSQ score	70.04 ± 18.02	72.65 ± 21.72	-4.250	<0.001

Numbers in bold indicate significant p-values.

pads per day and total MSQ score was significantly found after the pandemic compared to before it. (Table 2)

Repeated measures ANOVA

More distress (Beta=0.68), more PTSD due to COVID-19 (Beta=0.19), a higher number of waterpipes smoked per week (Beta=1.20) and being infected by the COVID-19 compared to not (Beta=3.98) were significantly associated with an increase in the MSQ score after the pandemic compared to before it. (Table 3)

DISCUSSION

Recently, several large studies explored impact of COVID-19 on menstrual cycle length, blood loss, and pain but the results are inconclusive.⁴⁷⁻⁴⁹ To the best of our knowledge, this study is the first to assess menstrual cycle, mental health, and their lifestyle throughout the COVID-19 pandemic, Beirut blast, and the economic crises among Lebanese females of reproductive age. Our results showed that more distress, more PTSD due to COVID-19, a higher number of waterpipes smoked per week, and being infected by the COVID-19 compared to not were significantly associated with an increase in the MSQ score after the pandemic compared to before it. Also, a significantly higher number of days of menses, number of pads per day and total MSQ score was significantly found after the pandemic compared to before it.

COVID-19 and menstrual pain and symptoms

This study showed that number of days of menses, number of pads per day, and menstrual pain and symptoms assessed through total MSQ score were higher after COVID-19 pandemic consistent with the results from other studies.^{50,51} According to Morgan, women after COVID-19 pandemic have experienced irregular menstrual cycles, including altered menstrual

duration, frequency, regularity, and volume, increased dysmenorrhea and worsened premenstrual syndrome.⁵²

The findings of this study can be interpreted by the fact that menstrual cycle is easily influenced by rising stress levels; COVID-19 pandemic can be a stress inducer due to the fear from lockdowns, from the new disease and the limited data about the efficacy of the preventive measures as vaccines, and the associated long-term complications.^{52,53} The menstrual cycle is regulated by interaction of hormones that affect the immune, vascular, and coagulation systems which exert a stroke influence on menstrual bleeding and severity of pre-menstrual symptoms. Psychological stress that can be manifested through COVID-19 is a known risk factor for hypothalamic dysregulation resulting in infrequent or absent menstruation.⁵⁴ It is further highlighted in different studies that women after COVID-19 infection had menstrual volume changes, prolonged menstrual cycle, altered menstruation onset, worsened premenstrual symptoms, and missed periods.^{33,55}

Our results showed that being infected by the COVID-19 was associated with an increase in menstrual symptoms after the pandemic. This can be explained by the fact that the infection with COVID-19 could affect the hypothalamic-pituitary-ovarian-endometrial axis with resulting changes to the menstrual cycle.⁵⁴ It has been supported that COVID-19 infection affects ovarian hormone production and endometrial responses at menses associated with exacerbation of progesterone-related pre-menstrual symptoms.^{56,57} Furthermore, COVID-19 has also been associated with endothelial cell dysfunction and alterations in the coagulation system, both critical components of endometrial function at menstruation, indicating a potential endometrial mechanism for menstrual disturbance.⁵⁸

Distress and PTSD due to COVID-19

Our results showed that more distress and more PTSD due

Variable	Beta	p	95% CI	Partial Eta Squared
Distress	0.68	0.002	0.25-1.10	0.025
PTSD due to COVID-19	0.19	0.022	0.03-0.36	0.014
Age	-0.25	0.094	-0.55-0.04	0.007
Number of waterpipes per week	1.20	<0.001	0.58-1.83	0.036
Infection by COVID-19 (yes vs no*)	3.98	0.040	0.18-7.78	0.011

Numbers in bold indicate significant p-values; variables entered in the model: age, body mass index, number of comorbidities, number of cigarettes smoked per day, number of waterpipes smoked per week, smoking cigarettes, smoking waterpipe, infected by COVID-19, intake of COVID-19 vaccine, anxiety, distress, depression, post-traumatic stress disorder (PTSD) due to the Beirut blast, PTSD due to the COVID-19 pandemic.



to COVID-19 were significantly associated with an increase in the menstrual symptom score after the pandemic consistent with the findings from previous studies.^{29,59} Our findings can be explained by the fact that psychological stress affects the areas of the brain underlying regulation of emotions in the luteal phase that alters menstrual cycles.⁶⁰ In addition, the level of anxiety encountered during COVID-19 accompanied by the increased sympathetic activity during acute stress increases neural activity in the brain resulting in menstrual irregularities.²⁹

Waterpipe smoking and menstrual changes

Our results showed that a higher number of waterpipes smoked per week is associated with an increase in the menstrual pain and symptoms consistent with previous literature.⁶¹ The finding can be explained by the fact the waterpipe smokers are exposed to high concentration of toxicants as carbon monoxide, carcinogenic polycyclic aromatic hydrocarbons, and tar, which increases follicular depletion and the loss of reproductive function.⁶⁰ It has also been assumed that waterpipe smoking is associated with shorter and more variable cycle and menses lengths due to its effect on steroid hormone levels and metabolism mediated by the chemicals that are known to be ovarian toxicants based on the data from cigarette smoking.⁶²

CLINICAL IMPLICATIONS

Our study highlights the need for early screening directed towards vulnerable females prone to developing menstrual changes during pandemic conditions by gynecologists and other healthcare professionals to initiate preventive and therapeutic strategies to minimize the severity of symptoms. Findings can inform policies to mitigate against gender inequalities in health and society, allowing us to 'build back better' post-COVID. Despite the provision of basic needs, raising awareness among general population, and promptly implemented actions to contain the pandemic, yet menstrual cycle changes were encountered during this period that should be thoroughly addressed and investigated as it is associated with long-term devastating consequences.

LIMITATIONS

The study is a cross-sectional design and thus cannot infer causality. The study lacks both external and internal validity since it relied on a small sample that was recruited via a snowball technique. Therefore, the findings may not be generalizable to other populations. Information bias could also exist as the study questionnaire was online and answers regarding menstrual cycle features as volume, pain and premenstrual symptoms are subjective and data are necessarily collected by self-report. Residual confounding bias is also possible since there might be

other factors associated with menstrual symptoms that were not taken into consideration in this study (medications intake, disease-induced menstrual changes).

CONCLUSION

Our main findings indicate that females had irregular menstrual cycles, unpredictable bleeding pattern, and intense symptoms severity post COVID-19 pandemic. Furthermore, stress post COVID-19 and Beirut blast tended to be associated with increased menstrual symptoms. Further research into the effects of COVID-19 and other health-related exposures on women's menstrual health is mandated. Thus, vulnerable women should be identified and offered appropriate care, information, and awareness regarding their menstrual period during a pandemic.

DECLARATIONS

Ethics Approval and Consent to Participate

The Psychiatric Hospital of the Cross Ethics Committee consented to this study's protocol (HPC-033-2021). Submitting the response on Google forms equaled obtaining a written informed consents from each respondent.

Consent for publication

Not applicable.

Availability of data and materials

The authors do not have the right to share the data as per their institutions policies, however, it is available upon a reasonable request from the corresponding author.

Competing interests

The authors declare no conflicts of interest.

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Authors' contributions

RI, VA and SH conceived and designed the survey. SH was involved in the statistical analysis and data interpretation. RI, DM and VA wrote the manuscript. DM involved in the data collection. TS, SO and SH reviewed the paper. All authors read the manuscript, critically revised it for intellectual content, and approved the final version.

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