The Relationship Between COVID-19 Infection and Changes in Psychological Health and Menstrual Function Among Jordanian Women

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Summary

Background The COVID-19 epidemic has affected not only physical health but also emotional and reproductive health, particularly in women. A growing amount of evidence suggests that menstrual cycle irregularities and psychological suffering may be associated with COVID-19 infection. The proposed study was designed to evaluate the impact of COVID-19 infection on mental health and menstrual cycles of Jordanian women.

Methods In this cross-sectional survey study, a total of 155 women of reproductive age with laboratory-confirmed SARS-CoV-2 infection were recruited using a non-probability sampling approach. Eligible participants included women within the reproductive age range who had a documented history of COVID-19 infection and were able and willing to provide informed consent. Participants were asked to retrospectively report their pre-infection status as well as their current post-infection condition, enabling within-participant comparative analysis of changes in menstrual patterns and psychological well-being potentially associated with SARS-CoV-2 infection. Data collection was conducted either through direct interaction or via secure and confidential survey methods, depending on participant accessibility and prevailing public health considerations, and all responses were reviewed for completeness and internal consistency prior to analysis. Descriptive statistical methods were used to summarize the data, while statistical analyses were applied to evaluate differences between pre- and post-infection variables and to explore potential associations among clinical, menstrual, and psychological factors. Appropriate statistical tests were selected based on the nature and distribution of variables, and a two-sided p value of less than 0.05 was considered statistically significant. All participants were fully informed about the study objectives, procedures, and their rights, and written informed consent was obtained before participation.

Findings The polymenorrhea was elevated after COVID-19 infection, but the menorrhagia was reduced. Depression and anxiety experienced a significant and statistically significant increase during the post-infection. Most of the symptoms were reported during the first six months of infection.

Interpretation COVID-19 infection was linked to the presence of substantial alterations in mental health and chosen menstrual patterns in Jordanian women.

Keywords COVID-19; menstrual cycle; mental well-being; anxiety; depression

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Introduction

The 2019-nCoV, an RNA virus that can infect the body, is the agent of the Coronavirus Disease 2019 (COVID-19).[1] As of this writing, it is a member of the coronavirus family, specifically the respiratory system, which was initially discovered in Wuhan, China, in late 2019.[2] In Jordan alone, the virus has been linked to over 8,400 deaths and over 695,390 confirmed cases.[3,4] The COVID-19 pandemic has caused enormous disruptions in the social, economic, and personal domains of life, as well as unusual demands on the population's health institutions. While it is commonly known that COVID-19 causes respiratory symptoms and other associated physical complications, there is growing scientific evidence that the human aspect of COVID-19 infection and the pandemic as a whole can have a substantial impact on mental health, contributing to the higher rates of psychological distress, anxiety, and depression.[5] Moreover, rising interest has been placed on its possible impact on reproductive health, especially in women, who might be more susceptible to pandemic-related stressors and physiological imbalances, which include the physical and psychosocial effects on health.[6]

The menstrual cycle is a complex and dynamic process governed by hormonal changes. It is a crucial part of reproductive health and well-being. Menstrual disturbances may include irregular menstrual cycles, abnormal bleeding, or alterations in menstrual flow and may have different causes such as hormonal imbalance, stress, lifestyle change, and some medical conditions.[7] Since COVID-19 is likely to affect physiological systems, it is reasonable to expect that the infection would affect women in their work and family spheres to a greater extent than others.[8] As the outbreak had impacted almost everyone, women encountered more particular barriers at work and home. Such effects as anxiety and tension are chronic symptoms of psychological discomfort that have been prevalent among communities across the world during the epidemic.

Numerous reports of the widespread negative effects of the COVID-19 epidemic have permeated the scientific literature.[10,11] It has affected people's mental health across the world.[12,13] Empirical research conducted

Research in Context

Evidence before this study

Prior to this investigation, the literature documented increased psychological distress and varied reports of menstrual disturbance associated with the COVID-19 pandemic and infection, principally from Europe, East Asia, and North America. Studies by Yuksel et al. and Aolymat et al. reported high proportions of younger women among COVID-19 cases and described menstrual and genital-health concerns in infected cohorts. Phelan et al. and Jing et al. described menstrual irregularities following COVID-19 and proposed potential ovarian or endocrine mechanisms. Large surveys and systematic reviews have identified elevated rates of anxiety and depression during the pandemic. However, few investigations applied a paired pre-/post-infection design in the same individuals or provided primary data from the Middle East, and none had reported detailed, temporally defined symptom trajectories from a Jordanian sample.

Added value of this study

This study provided region-specific, paired pre-/post data on 155 laboratory-confirmed cases in Jordan, with standardized observation windows (three months pre-infection; six months post-infection) and validated instruments (GAD-7, PHQ-9). It demonstrated a statistically significant increase in polymenorrhea after infection (0.6% to 3.2%) and a significant reduction in self-reported menorrhagia (25.2% to 15.5%), while documenting a large and statistically robust rise in depressive (1.3% to 43.9%) and anxiety symptoms (2.6% to 29.0%). Temporal analysis showed most gynecological symptoms clustered in the first month and within six months after infection. The sample was predominantly young (64.5% aged 20-29), and almost all cases were managed at home, which contextualizes the findings for community-managed, mild disease.

Implications of all the available evidence

Taken together with prior reports, these data indicate that COVID-19 is associated with measurable short-term perturbations in women's mental health and selected menstrual parameters. Clinicians and public-health programmes in similar settings should consider routine screening for anxiety, depression, and menstrual irregularities during post-COVID follow-up, even for non-hospitalized patients. The divergent direction of bleeding-related outcomes (decrease in menorrhagia here versus increases reported elsewhere) highlights heterogeneity and the need for longitudinal, mechanistic studies that control for confounders (contraceptive use, medications, vaccination, pre-existing gynecological conditions) to determine causality and duration of effects.

During the pandemic, it consistently reveals high levels of anxiety, depression, and general psychological discomfort.[14,15] There is still little data on the connection between COVID-19 infection, female mental health, and menstrual health, despite an increase in research on COVID-19's effects on mental health. The lack of a thorough investigation into the relationship between COVID-19-related psychological distress and changes in menstrual function represents a gap in the literature. The current study intends to investigate the impact of COVID-19 infection on the characteristics of menstrual cycles and the psychological well-being of Jordanian women in order to address this shortcoming. By focusing on this population, the study aims to clarify potential connections between menstrual cycle abnormalities and mental health issues in the post-COVID-19 infection. A better comprehension of these relationships can lead to a more thorough understanding of the health outcomes attained by women both during and after the pandemic and aid in the development of more tailored clinical and public health solutions for the Jordanian setting.

Significance of the Study

It is essential to understand how COVID-19 infection affects Jordanian women's menstrual cycles, and mental health is crucial. The pandemic has had a significant impact on Jordan, with several verified cases and associated economic and health consequences.[16] In addition, women make up a sizable portion of Jordan's labor force and are vital to families and the community. The examination of these possible impacts will help healthcare professionals and policymakers devise specific interventions and support measures to address the specific needs of women affected by the pandemic. Finally, the study of how COVID-19 affects the mental health of women in Jordan and their menstrual cycles can become part of the body of knowledge worldwide and help better understand the complex effects of this viral infection.

Methods

Study design

In our research, a cross-sectional design was used, and the study was conducted in Jordan to examine how COVID-19 infection affects the menstrual cycle and the mental health of infected women. In this research, we took into consideration a normal cycle length that lies between 21 and 35 days, oligomenorrhoea, which is a period that lies between 35 days and 3 months, polymenorrhea, which is characterized by a cycle length that is lower than 21 days, and menorrhagia, characterized by heavy and or prolonged cycles.

Term	Definition
Normal menstrual cycle	21–35 days
Oligomenorrhoea	Interval of 35–90 days between cycles
Polymenorrhea	Cycle length less than 21 days
Menorrhagia	Heavy and/or prolonged bleeding (self-reported)
Pre-COVID period	Three months before the positive test
Post-COVID period	Six months after a positive test

Table 1. Operational Definitions and Observation Windows

Participants and Inclusion Criteria

Females who had positive test results of COVID-19 during Mar 1, 2020, to Feb 28, 2021, were included in the study. Only those participants who fulfilled this criterion were recruited for the study.

Data Collection

To gather information, the authors employed an online survey. To increase comprehension and reach the local community, the questionnaire was initially developed in English and then translated into Arabic. It was divided into four sections.

Informed Consent

The consent form, which described the goals of the study and how the data would be used, was included in the first section of the questionnaire.

Demographic Information

To gather information, the authors employed an online survey. To increase comprehension and reach the local community, the questionnaire was initially developed in English and then translated into Arabic. It was divided into four sections.

Section	Key content	# items
Consent	Study purpose: voluntary participation	1
Demographics	Age, residency, parity, occupation, income, weight, height	10
Menstrual history	Cycle length pre/post, dysmenorrhea, menorrhagia, intermenstrual bleeding	12
Mental well-being	GAD-7, PHQ-9 items	16
Clinical COVID data	Date of positive test, severity, comorbidities	4

Table 2. Questionnaire Structure

Menstrual Cycle Assessment

The third part of the questionnaire focused on participants' menstrual cycles before and after COVID-19 infection. It contained questions on the length of the cycle, the period of menstruation, intermenstrual bleeding, pelvic pain, loin pain, dysmenorrhea, menorrhagia, oligomenorrhea, polymenorrhea, and vaginal discharge

Mental Well-Being Assessment

The mental well-being was assessed with the help of a validated psychological assessment tool. The anxiety symptoms measured using self-report were assessed using the Generalized Anxiety Disorder-7 (GAD-7) scale, which is commonly used to screen and determine the severity of anxiety problems. The GAD-7 has seven items assessing the intensity of anxiety-related symptoms that a participant has experienced within a certain period of recollection. Each item has four responses with a four-point Likert scale, with the lowest one being not at all (score 0) and the highest one being almost every day (score 3). The cumulative GAD-7 score is obtained by adding all the answers to the 7 items, and this gives the cumulative score

that falls in the range of 0-21. An increase in the total scores will be associated with an increase in the severity of anxiety symptoms, which will make it possible to conduct a quantitative evaluation of the psychological state of the participants. The cutoff value was 10 in this study, as this is a standardized tool that is a reliable measure of anxiety and would allow a consistent comparison of mental well-being across the participants and the interpretation of the outcomes related to anxiety in the context of COVID-19 infection. [17]

The PHQ-9 (Patient Health Questionnaire-9) was employed to research self-reported depression. The levels of participants were assessed on a scale of 0 to 3 on the levels of their depression, where the first position was not at all depressed, followed by almost daily, feeling depressed. The recall time was 2 weeks, and the overall score ranged from 0 to 27. There was an increased likelihood of depression with a higher score level, indicating the likelihood of severe depression. [18]

Statistical Analysis

The Statistical Package of the Social Sciences (SPSS), version 24, was used to statistically evaluate the data. Descriptive and inferential statistical methods were used to examine patterns and relationships in the data set. In order to provide an overall picture of participant characteristics, menstrual cycle characteristics, and mental health outcomes, categorical variables were summarized using frequencies and percentages. The menstrual cycle characteristics before and after the COVID-19 infection were compared using the McNemar test or chi-square test. When the expected cell count was insufficient to meet the chi-square test's requirements, Fisher's exact test was employed to ensure the analysis's accuracy. The relationship between COVID-19 infection status and variation in menstrual cycle patterns was examined using statistical tests. In order to analyze, the pre-COVID-19 period was defined as three months prior to a positive test, and the post-COVID-19 period as six months following infection confirmation. This temporal classification made it possible to compare the outcomes in the pre-infection and post-infection periods in a systematic manner. Every statistical test was two-tailed, and a significant correlation between the variables being examined was indicated by a p-value less than 0.05.

Results

A total of 155 women completed the questionnaire. The majority, 100 (64.5%), of the women were between 20-29 years of age, 77 (49.7%) were employed, and 46 (29.7%) were either high school or university students (Figure 1 and Table 3).

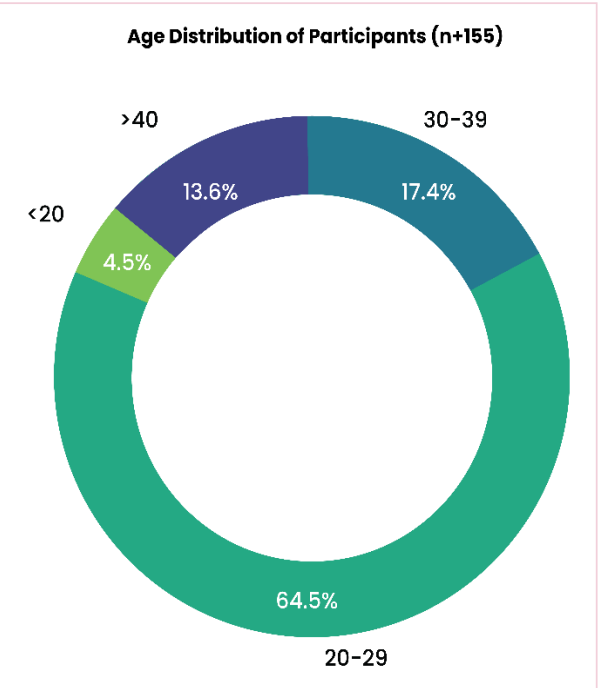

Figure 1. ***Participant Characteristics***

More than half, 90 (58.1%), of the participants were single. About one-third of participants, 49 (31.9%), live in Amman, followed by 36 (23.2%) in Irbid and 32 (20.6%) in AlKarak (Figure 2 and Table 3).

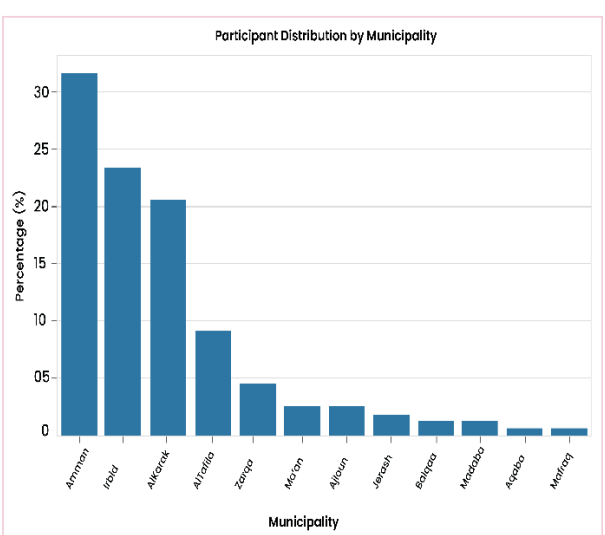

Figure 2. ***Participant Distribution by Location***

BMI distribution was relatively heterogeneous, with 52.3% of participants having a BMI of less than 25 kg/m² and 4.5% having a BMI of more than 30 kg/m² shown in Figure 3.

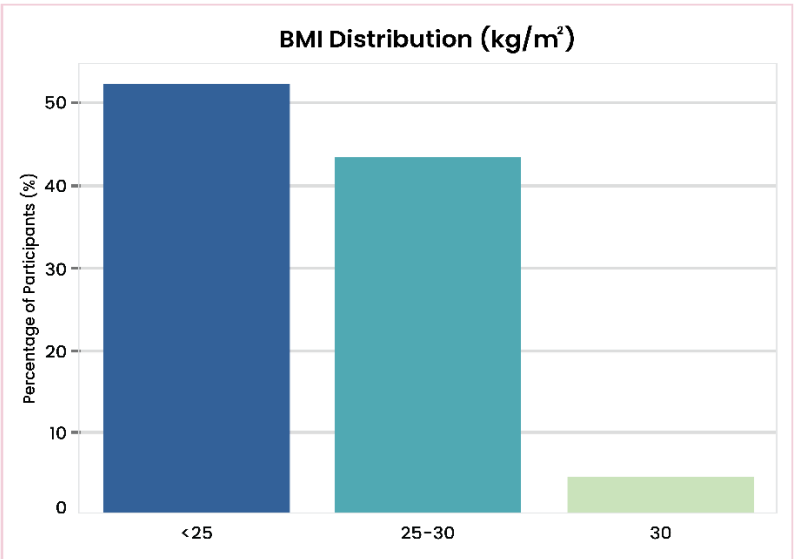

*Figure 3. **BMI Distribution of Participants***

Most married participants, 52 (85.2%), were married between 20 and 25 years of age, and only 2 (3.3%) married before age 20. Overall, 31 (47.7%) of women were multiparous with parity between 1-4, 24 (36.9%) were multiparous between 5-9, and only 10 (15.4%) were nulliparous, as shown in Table 3.

Table 2. Questionnaire Structure

Characteristic	Number (%)	Characteristic	Number (%)
Age (years)		**Occupation**	
<20	7 (4.5)	Student	46 (29.7)
20–29	100 (64.5)	Employed	77 (49.7)
30–39	27 (17.4)	Unemployed	32 (20.6)
≥40	21 (13.6)		
Body Mass Index (kg/m²)		**Marital Status**	
<25	81 (52.3)	Single	90 (58.1)
25–30	67 (43.2)	Married	61 (39.4)
>30	7 (4.5)	Divorced	4 (2.5)
Hospital admission		**Income (Jordanian Dinar)**	
Admitted	1 (0.6)	<300	58 (37.4)
Not admitted	154 (99.4)	300–500	53 (34.2)
		501–1000	28 (18.1)
		>1000	16 (10.3)
Marriage age (years)*		**Residency municipality**	
<20	2 (3.3)	Ajloun	4 (2.6)
20–25	52 (85.2)	AlKarak	32 (20.6)
>25	7 (11.5)	Amman	49 (31.6)
Parity**			
Nulliparous (0)	10 (15.4)	Aqaba	1 (0.6)
Multiparous (1–4)	31 (47.7)	AlTafila	14 (9.0)
Multiparous (5–9)	24 (36.9)	Balqaa	2 (1.3)
		Irbid	36 (23.2)
		Jerash	3 (1.9)
		Ma'an	4 (2.6)
		Madaba	2 (1.3)
		Mafraq	1 (0.6)
		Zarqa	7 (4.5)

* Marriage age only applicable to married participants

** Parity only applicable to married & divorced participants (N=65)

Table 3. Study Population Characteristics and Demographics (N=155)

No significant statistical differences were observed between the percentage of participants experiencing vaginal discharge, pelvic pain, loin pain, or dysmenorrhea before and after COVID-19 infection. However, there was a notable increase in polymenorrhea following COVID-19 infection compared to before (3.2% vs. 0.6%, p=0.046). Conversely, the prevalence of menorrhagia was significantly higher before COVID-19 infection compared to the post-infection period (25.2% vs. 15.5%, p=0.048) (Table 4).

Table 4a. Comparison of Gynaecological Symptoms Pre- and Post-COVID-19 Infection (n = 155)

Symptom	Pre-COVID-19 infection, n (%)	Post-COVID-19 infection, n (%)	p-value (McNemar)
Vaginal discharge	41 (26.5)	39 (25.2)	>0.05
Pelvic pain	20 (12.9)	18 (11.6)	>0.05
Loin pain	24 (15.5)	25 (16.1)	>0.05

Table 4a. Comparison of Gynaecological Symptoms Pre- and Post-COVID-19 Infection (n = 155)

Table 4b. Comparison of Menstrual Cycle Disorders Pre- and Post-COVID-19 Infection (n = 155)

Symptom	Pre-COVID-19 infection, n (%)	Post-COVID-19 infection, n (%)	p-value (McNemar)
Dysmenorrhea	37 (23.9)	39 (25.2)	>0.05
Menorrhagia	39 (25.2)	24 (15.5)	0.048*
Oligomenorrhea	16 (10.3)	16 (10.3)	1
Polymenorrhea	1 (0.6)	5 (3.2)	0.046*

Table 4b. Comparison of Menstrual Cycle Disorders Pre- and Post-COVID-19 Infection (n = 155)

Table 4c. Comparison of Mental Well-Being Pre- and Post-COVID-19 Infection (n = 155)

Symptom	Pre-COVID-19 infection, n (%)	Post-COVID-19 infection, n (%)	p-value (McNemar)
Depression	2 (1.3)	68 (43.9)	<0.001*
Anxiety	4 (2.6)	45 (29.0)	<0.001*

Table 4c. Comparison of Mental Well-Being Pre- and Post-COVID-19 Infection (n = 155)

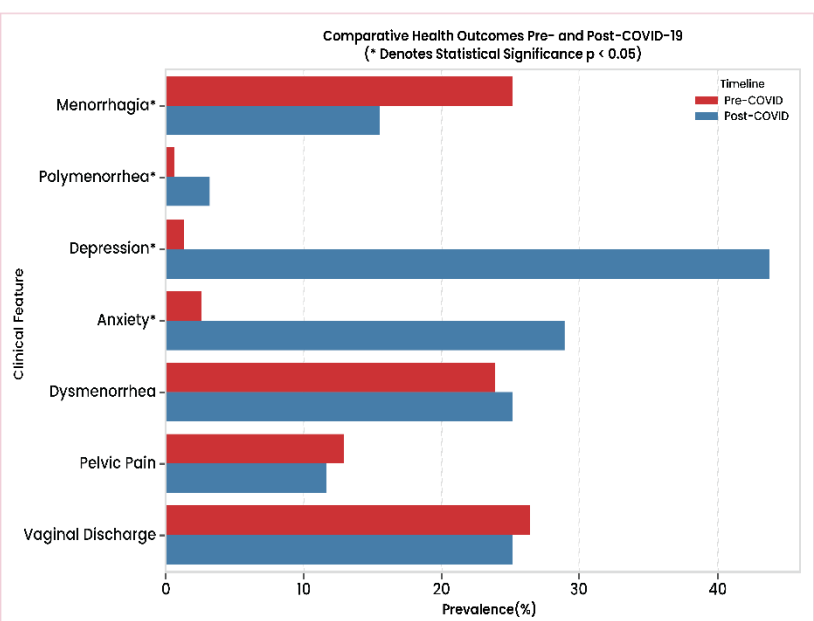

Figure 4. Symptoms Reported Pre-COVID-19 Infection

Figure 4 shows the occurrence of the symptoms before the COVID-19 infection, where there were 1.3 and 2.6 percent of those who reported depression and anxiety, respectively. Conversely, Table 4c found that depression (43.9%) and anxiety (29.0%) were greater in post-COVID-19 analysis, which has attained statistical significance ($p < 0.001$).

Discussion

Our study is the sole investigation focusing on the connection between menstrual cycle changes and mental well-being in Jordanian women with COVID-19 infection. Among the participants in our study, a majority of 64.5% fell within the age range of 20–29 years. These findings align with previous reports by Yuksel et al. and Aolymat et al., wherein the latter study observed that around 70% of Jordanian women infected with COVID-19 were between 25 and 34 years old.[1,4] According to the observed findings, one might say that women aged 20–29 had more chances to take public transport; therefore, they are more likely to take it. This difference is the opposite of other areas, where a considerable percentage of Asian women infected with COVID-19 were mostly aged 40–60 years. The same trends have been observed in other studies carried out in Europe and North America, and have suggested that women aged 45–55 years were at the highest risk of contracting COVID-19 infection.[19] This fact may be explained by the introduction of online education to the university and high-school students as early as Mar 15, 2020, which was not universal among all employed women. The absence of this feature, in turn, puts them at higher risk of getting exposed to the virus.[20]

Moreover, we found that there is a correlation between the low income of a family and the higher risk of contracting the COVID-19 virus. This is attributed by the fact that more people can be found in low-income households and they might encounter problems like poor nutrition, poor sanitation and increased cases of uncontrolled chronic diseases, as noted in a study by Akseer et al.[21] Additionally, because of the inaccessibility to privately-owned cars, lower-income households usually also use public transportation more frequently, exposing them to potential risks of infection. There were more single-infected women, as per our findings. This may be credited to the fact that married and divorced women are usually required to be at home to monitor the online learning of their children. On the other hand, single females had higher chances to go back to work and travel without any predicament. Most participants of our study, which is about 99.4%, were handling the COVID-19 infection at home. This percentage can be explained by the younger age of the patients under analysis and the relatively reduced risk of serious morbidity in younger people. Hospital admission rate was reported to be higher in China, with percentages ranging between 1% and 4.3% in people aged 20-29 and 40-49, respectively.[22]

Loin pain and dysmenorrhea were reported most within the first month after infection, with fewer reports between one and six months, and only a small minority reported symptoms at six months post-infection. We observed a statistically significant increase in polymenorrhea following COVID-19 infection (from 0.6% to 3.2%, $p = 0.046$), indicating more frequent short cycles in the post-infection period. Conversely, the prevalence of menorrhagia declined after infection (from 25.2% pre-infection to 15.5% post-infection, $p = 0.048$). Mental health outcomes demonstrated marked deterioration after infection: depression increased from 1.3% pre-infection to 43.9% post-infection, and anxiety rose from 2.6% to 29.0% (both $p < 0.001$). These sizeable increases suggest a substantial psychological burden associated with COVID-19 infection in this cohort and are consistent with reports documenting elevated rates of depression and anxiety among COVID-19 survivors in other settings.[17,23] Multiple factors, such as sustained physical symptoms, isolation, socioeconomic stressors, and perceived stigma, may contribute to these findings.

The observed increase in polymenorrhea after infection may reflect acute physiological effects of the viral illness, stress-mediated hypothalamic-pituitary-ovarian axis disruption, or behavioral changes (for example, alterations in sleep, activity, or medication use) occurring during or shortly after infection. Jing et al. suggested that ovarian dysfunction caused by the viral illness could be responsible for such disturbances.[24] The simultaneous and pronounced rise in anxiety and depressive symptoms raises the possibility that psychological distress contributed to the menstrual alterations observed, consistent with literature linking stress and mood disorders to menstrual irregularities.[7,25] The decline in reported menorrhagia in the post-infection period is notable and contrasts with some prior reports; Phelan et al. described increases in bleeding abnormalities following COVID-19.[25] Potential explanations for the reduced self-reported heavy bleeding include changes in medication use (including treatments for anxiety or depression), reporting bias, or transient cycle-to-cycle variability. Further investigation is required to elucidate causal pathways.

Limitations

Limitations of the study remain. The cross-sectional design and retrospective self-reporting introduce potential recall bias and preclude causal inference. The snowball sampling strategy and online data collection may limit generalizability and favor younger, more connected participants. Additionally, the dramatic rise in post-infection depression and anxiety warrants cautious interpretation; symptom reporting may be influenced by contemporaneous pandemic stressors and the absence of baseline clinical diagnostic confirmation.

Conclusion

The research evidence is that the COVID-19 infection is related to the measurable variation of menstrual patterns and a significant negative shift in mental

health among women in Jordan. Although the majority of gynecological symptoms failed to be significantly different between pre-infection and post-infection, there was a statistically significant increase in polymenorrhea and a decrease in menorrhagia after COVID-19 infection. Depression and anxiety, conversely, registered a significant and statistically significant increase during the post-infection period, which meant that the disease had a significant psychological effect. Most participants had these symptoms in the first six months after infection, and they decreased thereafter. On the whole, the results propose that COVID-19 has an impact on the reproductive and mental health of women even when they are treated at home without any hospitalization. The findings point to the significance of encompassing mental health screening and menstrual health evaluation in post-COVID care in women. More longitudinal research is warranted to elucidate the mechanisms underlying COVID-19 infection, evaluate long-term patient outcomes, and inform more targeted interventions to reduce the reproductive and psychological impacts of COVID-19.

Declaration of interests

All authors declare that they have no competing interests.

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n/a

Authors' contributions

SX and HA developed the study design. SX led data collection and interpretation. SX drafted and revised the manuscript. SX and SZ reviewed and revised the manuscript. All authors read and approved the final manuscript.

Data sharing

Please contact the corresponding author for more information.

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