Hamid, *et al. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)*. 2022; 17 (Special Issue 1): 39-43
DOI: 10.21109/kesmas.v17i2.6061

Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)

The Effect of COVID-19 Pandemic-Induced Stress on Reproductive-Age Women's Menstrual Cycle Regularity

Ruaa Abduljabbar Hamid*, Zahraa Noah Fathi, Raida Al-Wazzan

Department of Obstetrics and Gynecology, College of Medicine, University of Mosul, Mosul, Iraq

Abstract

Intense stress resulting from major life events can affect women's menstrual cycle. The current Coronavirus Disease 2019 (COVID-19) pandemic, impacting various sectors, is considered a major form of stress. During May-November 2020, some women in Iraq have experienced menstrual disruptions, which can happen whether they get infected with the COVID-19 or simply deals with pandemic-induced stress. Thus, this study aimed to evaluate the effect of the COVID-19 pandemic-induced stress on menstrual cycle regularity of reproductive-age women. This study used an observational cross-sectional design conducted in Iraq from May to November 2020. A sample of 500 reproductive-age women filled out an online questionnaire about their menstrual records and psychological stress levels using a Perceived Stress Scale-10 for three months during the pandemic. A comparison between menstrual cycle irregularity and stress levels before and during the pandemic was done with a p-value of <0.05 and statistically significant. It was found that 47.72% of women had irregular menstrual cycles and high perceived stress scales during the pandemic compared to 20.94% with irregular cycles and high-stress levels before the pandemic. In brief, the high-stress level induced by the COVID-19 pandemic is associated with the irregular menstrual cycle in the sampled reproductive-age women.

Keywords: COVID-19 pandemic, menstrual cycle, Perceived Stress Scale

Introduction

It is well known that intense stress resulted from major life events such as wars, separation from family, and moving to a new place can all affect women's menstrual cycle.[1] The current Coronavirus Disease 2019 (COVID-19) pandemic is considered a major form of stress as it impacts various sectors, from public health to the economy sectors.[2] Based on the authors' initial study, in Iraq, some women have experienced menstrual disruptions (irregularity, menorrhagia, hypomenorrhea, oligomenorrhea, and polymenorrhea) during the period of strict quarantine (May-November 2020), which can occur either they get infected with the COVID-19 or simply dealing with pandemic-induced stress. A normal menstrual cycle is 28 days long and ends with the shedding of endometrium and bleeding. This cycle indicates a healthy hypothalamic-pituitary-ovarian axis with a normal outflow tract.[3-5]

The Neuroendocrine system plays a vital role, influencing the reproductive organs and endocrine systems to help adapt to the increased stress and high cortisol levels. This condition may adversely affect the normal luteinizing hormone rhythm and thus disrupt the regular menstrual cycle.[6] Moreover, stress may even cause amenorrhea.[7] Menstrual cycle irregularity is an important sign of anovulation associated with decreased ovarian hormone production, which may lead to infertility, heart disease, and type 2 diabetes mellitus (T2DM).[8]

The ongoing COVID-19 pandemic is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and was first recognized in December 2019 in Wuhan City, Hubei Province, China. The World Health Organization (WHO) announced the outbreak as a Public Health Emergency of International Concern (PHEIC) in January 2020 and a pandemic in March 2020. As of March 24, 2021, more than 124 million cases had been diagnosed, with more than 2.73 million COVID-19 deaths globally.[9]

The WHO expresses concerns over the psychosocial and mental health consequences secondary to the pandemic and assumes that new precautions such as quarantine have adversely affected people's daily activities and economy, which may increase anxiety, depression, and insomnia.[10] The psychological and mental health of health care providers is an emerging concern, where they practice their work under stressful and resource-limited

Correspondence*: *Ruaa Abduljabbar Hamid, Department of Obstetrics and Gynecology, College of Medicine, University of Mosul, Mosul, Iraq, Email: roaa.abduljabbar@uomosul.edu.iq, Phone: +96 475 1855 4711*

Received : July 03, 2022
Accepted : July 20, 2022
Published: July 31, 2022

settings and are constantly exposed to the risk of infection.[10]

The Perceived Stress Scale (PSS) is the most widely-used psychological tool for measuring stress awareness. Items are designed to measure how unexpected, out of control, and burden the respondents find their lives. It includes several questions asking about the level of stress and focusing in general perspective and are devoid of contents specific to any subpopulation group. Each participant is asked to indicate how frequently they felt or thought in a particular way.[11] Thus, this study aimed to demonstrate the effect of the COVID-19 pandemic-induced stress on different aspects of the menstrual cycle in healthy reproductive-age women with a previously normal cycle with a subgroup of health care workers who were in close contact with the COVID-19 cases compared to those who were not.

Method

This study used an observational cross-sectional design conducted in Iraq during the period of strict quarantine between May and November 2020. The sample included 500 women aged 18-44 years. Furthermore, the data collection was conducted using an online self-administered questionnaire (Google Forms) distributed via Facebook, WhatsApp, and Telegram. The questionnaire consisted of four parts, with a total of 36 questions. The written consent of the participants was obtained during the survey, and their anonymity was maintained throughout the study.

The first part collected participants' demographic data (age, country of residence, education level, marital status, financial status, contraceptive use, lactation status, and chronic disease during the pandemic). The second included questions on the menstrual records within three months during the period of strict quarantine in Iraq (March, April, and May 2020). The third part assessed the risk factors for menstrual cycle irregularities in the six months preceding the pandemic, and the last measured the psychological stress levels of the participants before and during the pandemic.

The stress was measured retrograde depending on the participants' recall of their psychological condition before the pandemic. Then they reported their psychological status during the pandemic using the Perceived Stress Scale-10, which is a Likert type of scale where 4 = Very often, 3 = Fairly often, 2 = Sometimes, 1 = Almost never, and 0 = Never. In the four positively-stated items (4, 5, 7, and 8), the scores were obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0) and then summing across all the scale items. The resulting values were divided into two intervals (≤20 = low-stress and >20 = high-stress).

The women older than 44 years and younger than 18 years old, lactating women, women on hormonal contraception, and those with chronic diseases (hypertension, diabetes, hepatic, cardiac adrenal disease) were excluded from the study, as these factors may be associated with anovulation or oligo-ovulation. The data were tabulated and statistically analyzed using Minitab 18 free version. The participants made a comparison between menstrual cycle irregularity and perceived stress scale before and during the pandemic with a p-value<0.05, which was statistically significant.

Results

Table 1 shows the demographic characteristics of the participants. Of 500 sampled women, 95 were excluded from the study as they did not meet the inclusion criteria (healthy women aged 18-44 years with normal menstrual cycle parameters before the pandemic). This study revealed that 34.81% of participants were aged 18-26 years, 52.09% were aged 27-36 years, and 13.08% were aged 37-44 years. The majority were living in Iraq at the time of the survey (88.88%). The education level showed that those attaining bachelor's degrees were 58.76%, 29.38%, 10.37%, and 1.48% were postgraduate, secondary school, and primary educational levels, respectively.

Furthermore, it was found that 60.49% were married, and 37.28% were single, 0.49% and 1.72% were widows and divorced, respectively. The financial status showed that 41.48% had a stable income and 58.51% did not have. Most of the sampled reproductive-age women were not using hormonal contraceptives (73.06%), while (26.93%) were using it. Only 17.14% of the sampled reproductive-age women were lactating, while 82.85% were not. Chronic disease was detected in

Table 1. The Demographic Characteristics of the Participants (n = 405)

Variable	Category	n	%
Age group (year)	18-26 years	141	34.81
	27-36 years	211	52.09
	37-44 years	53	13.08
Country of residence	Inside Iraq	360	88.88
	Outside Iraq	45	11.11
Educational level	Primary education	6	1.48
	Secondary	42	10.37
	Bachelor's degree	238	58.76
	Master's and Doctoral	119	29.38
Marital status	Married	245	60.49
	Single	151	37.28
	Widow	2	0.49
	Divorced	7	1.72
Financial status	Stable income	168	41.48
	Unstable income	237	58.51
Contraceptive use	Use contraceptive	66	26.93
	Non contraceptive user	179	73.06
Lactation status	Lactating	42	17.14
	Non-lactating	203	82.85
Chronic diseases	Present	28	6.91
	Absent	377	93.08

6.91% of participants, while 93.08% enjoyed good health.

This study showed that 22.72% of women had irregular menstrual cycles before the COVID-19 pandemic. During the pandemic, it was raised to 43.21% (Figure 1). Before the COVID-19 pandemic, 20.94% of the reproductive-age women had an irregular menstrual cycle with a PSS of >20, and 25.15% with a score of ≤20, the p-value was 0.13. During the COVID-19 pandemic, 47.72% of the reproductive-age women had an irregular cycle with PSS more than 20; while, the reproductive-age women with a score of ≤20 who had an irregular menstrual cycle was 36.59% (Table 2).

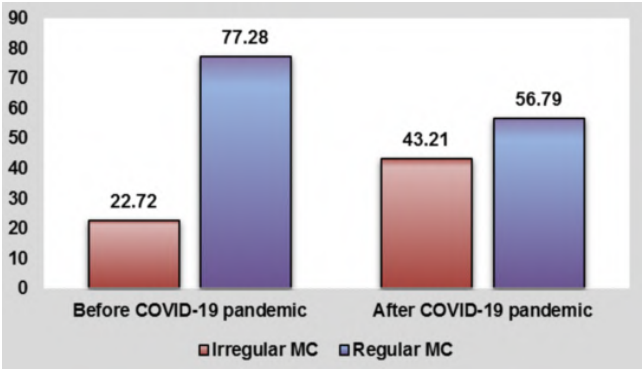

Figure 1. The Percentage of Menstrual Cycle Irregularity Before and During the COVID-19 Pandemic

This study showed that a higher percentage of reproductive age women with PSS higher than 20 had dysmenorrhea compared to women with low PSS, 54.36% and 32.93%, respectively, with a p-value of 0.001. Similarly, the higher percentage of women with high stress level developed hypomenorrhea compared to those with low stress level, 53.94% and 33.33% (p-value = 0.001), respectively. The p-value was also significant (0.002) for menorrhagia in association with high stress level. Although the higher percentage of women with high stress level developed oligomenorrhea (28.22%), the p-value was not significant (0.06). Similarly, the p-value was not significant for high stress and polymenorrhea (0.29). Some participants reported to have more than one menstrual disorder in their response to the questionnaire (Table 3).

The health care workers who had contact with COVID-19 cases and PSS score of less than 20 were 19 (11.59%), while those who had not and had a PSS score of more than 20 were 145 (88.41%). At the same time, the PSS score of more than 20 revealed that 41 (17.01%) health care workers had contact with COVID-19 cases and 200 (82.99%) had not (Table 4). There were 60 health care workers who had contact with the COVID-19 cases. However, 33 experienced irregular menstrual

Table 2. The Association between High-Stress Levels and Menstrual Irregularity Before and During the COVID-19 (n = 405)

Menstrual Irregularity	Before COVID-19				Menstrual Irregularity	During COVID-19			
	PSS≤20		PSS>20			PSS≤20		PSS>20	
	n	%	n	%		n	%	n	%
Irregular (n = 92)	43	25.25	49	20.94	Irregular (n = 175)	60	36.59	115	47.72
Regular (n = 313)	128	74.85	185	79.06	Regular (n = 230)	104	63.41	126	52.28
p-value	0.13				p-value	0.021			

Note: PSS = Perceived Stress Scale

Table 3. The Association of High-Stress Level and Menstrual Cycle Changes During the Pandemic

Characteristic of the Menstrual Cycle	Category	Perceived Stress Scale				p-value
		≤20		>20		
		n	%	n	%	
Dysmenorrhea	Present (n = 185)	54	32.93	131	54.36	
	Absent (n = 220)	110	67.07	110	45.64	0.001
Hypomenorrhea	Present (n = 185)	55	33.33	130	53.94	
	Absent (n = 220)	109	66.67	111	46.06	0.001
Menorrhagia	Present (n = 112)	39	17.68	83	34.44	
	Absent (n = 293)	135	82.32	185	65.56	0.002
Oligomenorrhea	Present (n = 101)	33	20.12	68	28.22	
	Absent (n = 304)	131	79.88	173	71.78	0.06
Polymenorrhea	Present (n = 45)	15	9.15	30	12.45	
	Absent (n = 360)	149	90.85	211	87.55	0.29

Table 4. The Association of Health Care Workers' Contact with COVID-19 Cases and High-Stress Level

Contact with COVID-19 Cases	Perceived Stress Scale			
	<20		>20	
	n	%	n	%
Present (n = 60)	19	11.59	41	17.01
Absent (n = 345)	145	88.41	200	82.99
p-value	0.68			

Tabel 5. The Association of Health Care Workers' Contact with COVID-19 Cases and Menstrual Cycle Irregularity

Contact with COVID-19 Cases	Menstrual Irregularity			
	<20		>20	
	n	%	n	%
Present (n = 60)	27	9.44	33	35.87
Absent (n = 345)	286	90.56	59	64.13
p-value	0.0001			

cycles, while the remaining 27, still had regular ones (Table 5). Meanwhile, health care workers who had no contact with the COVID-19 cases mainly experience a regular menstrual cycle (90.56%).

Discussion

This study intended to demonstrate the effect of stress on menstrual cycle parameters in healthy reproductive-age women with previously regular menstrual cycles. The demographic characteristics showed that more than half of the participants were less than 36 years old and living Iraq during the survey. Most participants had bachelor's degrees, were married, did not use contraceptives, but enjoyed good health. However, less than half had a stable income and were lactating.

The findings of this study revealed that the sampled women experienced irregular menstrual cycles with a high-stress level of PSS>20 with a p-value of 0.021. These results were similar to the study by Nagma, *et al.*,[12] which showed an association between irregular menstrual cycles and high-stress levels in undergraduate medical students (PSS score>20). This study showed that high-stress level was associated with dysmenorrhea in the sampled women with a p-value of 0.001. This condition was in line with a study focusing on female medical students of Universitas Padjadjaran Bandung, West Java Province, Indonesia, which showed an association between the severity of stress and dysmenorrhea in the last menstruation.[13] However, the study by Nagma, *et al.,* stated different findings which did not show an association between high-stress levels and dysmenorrhea.[12]

This study showed that women with high-stress levels were more likely to develop disruption in the amount of menstrual blood loss, whether increased loss (menorrhagia) or decreased loss (hypomenorrhea) (p-value = 0.02 and 0.01, respectively). However, these findings were subjective and dependent on the patient's appreciation of the amount of loss. Another study supporting these findings stated that higher stress was associated with painful periods, heavy menstrual bleeding, and premenstrual symptoms.[6] The association between high-stress levels and changes in menstrual cycle intervals, whether increased interval (more than 35 days) oligomenorrhea or decreased interval (less than 21 days), did not show in this study. While, Fenster, *et al.,* found that women working in high-stress jobs were twice as likely to have a short interval between menstrual cycles compared to women working in non-stressful jobs.[14] However, larger sample size and more extended follow-up period are needed to confirm or negate this finding.

Another study of female American and Italian nurses experiencing stress demonstrated an association between high-stress levels and both longer cycles and anovulation.[15] In the present study, although a higher percentage of contacts with COVID-19 had high-stress scores (PSS>20), the p-value was not significant (0.68). It might be because of the small sample size and the number of women in contact with COVID-19 positive cases in Iraq during the survey. Additional studies are needed to demonstrate the effect of contact with COVID-19 cases on stress levels among health care workers.

This study showed an association between health care workers' contact with COVID-19 cases and irregular menstrual cycle (p-value = 0.0001). This finding might be explained by higher demand in the work setting with increasing shifts in quantity and quality. A Korean study shared a similar result and stated an association between irregular menstrual cycles and the professional specifications of female workers.[16]

Stress stimulates the hypothalamic-pituitary-adrenal (HPA) axis, and the hypothalamus will release corticotropic-releasing factor (CRF) hormone, which stimulates the pituitary to release adrenocorticotropic hormone (ACTH) into the blood. In turn, the ACTH stimulates the adrenal glands to produce cortisol. These hormones control stress response in the body and can suppress the release of normal levels of reproductive hormones leading to irregular ovulation, anovulation, or amenorrhea, depending on the degree of gonadotrophin-releasing hormone (GnRH) suppression.[17-21] Thus, stress adversely affect menstrual cycle regularity by stimulating the HPA axis which may suppress GnRH release.

Conclusion

The high stress induced by the COVID-19 pandemic is associated with menstrual cycle irregularity in the sampled reproductive-age women. Moreover, the high stress and dysmenorrhea, hypomenorrhea, and menorrhagia show a relationship in the present study, but not for oligomenorrhea or polymenorrhea. Health care workers who have direct contact with COVID-19 cases relate to the irregular menstrual cycle. However, larger sample size and more extended follow-up period are needed to confirm or negate this finding.

Abbreviations

COVID-19: Coronavirus Disease 2019; T2DM: type 2 Diabetes Mellitus; SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus 2; WHO: Wolrd Health Organization; PHEIC: Public Health Emergency of International Concern; PSS: Perceived Stress Scale; HPA: Hypothalamic-Pituitary-Adrenal; CRF: Corticotropin-Releasing Factor; ACTH: Adrenocorticotropic Hormone; GnRH: Gonadotrophin-Releasing Hormone.

Ethics Approval and Consent to Participate

Ethics approval was obtained from the scientific committee in the College of Medicine, University of Mosul, 2020. The written consent of the participants was obtained during the survey, and their anonymity was maintained throughout the study.

Competing Interest

The authors declare that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and complementary findings are available when requested by the publisher.

Authors' Contribution

RAH, ZNF, and RMAW made substantial contributions to the study's conception, design, acquisition, analysis, and interpretation of data. RAH, ZNF, and RMAW took part in the critical revision of the study for intellectual content, gave the final approval for this version to be published, and agreed to be accountable for all aspects of the work.

Acknowledgment

The authors are grateful to the College of Medicine, University of Mosul, for their scientific guidance and support. The authors would also like to thank all the participants for contributing to this study.

References

1. Everyday Health. How COVID-19 can mess with menstrual periods. Everyday Health; 2021.
2. Arumsari I, Fauzi R, Maruf MA, Bigwanto M. Economic or public health? Southeast Asia's tackling of COVID-19 a year later. Kesmas. 2021; 16 (1): 90-6.
3. Bianco V, Cestari AM, Casati D, Cipriani S, Radici G, Valente I. Premenstrual syndrome and beyond: lifestyle, nutrition, and personal facts. Minerva Ginecol. 2014; 66 (4): 365-75.
4. Poromaa IS. Physiological correlates of premenstrual dysphoric disorder (PMDD). Curr Top Behav Neurosci. 2014; 21: 229-43.
5. Xiao S, Coppeta JR, Rogers HB, Isenberg BC, Zhu J, Olalekan SA. A microfluidic culture model of the human reproductive tract and 28-day menstrual cycle. Nat Comm. 2017; 8 (1): 1-13.
6. Singh R, Sharma R, Rajani H. Impact of stress on menstrual cycle: a comparison between medical and non medical students. Saudi J Health Sci. 2015; 4 (2): 115.
7. Munjal P, Nair M. Amenorrhea. Innov AiT. 2021; 14 (10): 599-606.
8. Bae J, Park S, Kwon JW. Factors associated with menstrual cycle irregularity and menopause. BMC Womens Health. 2018; 18 (1): 36.
9. Page J, Hinshaw D, McKay B. In hunt for Covid-19 origin, patient zero points to second Wuhan market – the man with the first confirmed infection of the new coronavirus told the WHO team that his parents had shopped there. The Wall Street Journal; 2021.
10. Kumar A, Nayar KR. COVID 19 and its mental health consequences. J of Ment Heal. 2020; 30 (1): 1–2.
11. Cohen S, Kamarck T, Mermelstein R. Perceived stress scale. American Psycho Assoc. 2014.
12. Nagma S, Kapoor G, Bharti R, Batra A, Batra A, Aggarwal A, et al. To evaluate the effect of perceived stress on menstrual function. J Clin Diagn Res. 2015; 9 (3): QC01-03.
13. Maryam, Ritonga MA, Istriati. Relationship between menstrual profile and psychological stress with dysmenorrhea. Amj. 2016; 3 (3): 382–7.
14. Fenster L, Waller K, Chen J, Hubbard AE, Windham GC, Elkin E, et al. Psychological stress in the workplace and menstrual function. Am J Epidemiol. 1999;149 (2): 127–34.
15. Hatch MC, Figa-Talamanca I, Salerno S. Work stress and menstrual patterns among American and Italian nurses. Scandinavian Journal of Work, Environment and Health. 1999; 25 (2): 144–50.
16. Ok G, Ahn J, Lee W. Association between irregular menstrual cycles and occupational characteristics among female workers in Korea. Maturitas. 2019; 129: 62–67.
17. Boutot M. Stress and the menstrual cycle. Clue; 2016.
18. Herbert C. Overcoming traumatic stress: a self-help guide using cognitive behavioural techniques. London: Hachette UK; 2017.
19. Rani K, Tiwari SC, Kumar S, Singh U, Prakash J, Srivastava N. Psycho-biological changes with add onyoga nidra in patients with menstrual disorders: a randomized clinical trial. J Caring Sci. 2016; 5 (1): 1-9.
20. Iliadis SI, Sylvén S, Hellgren C, Olivier JD, Schijven D, Comasco E, et al. Mid–pregnancy corticotropin–releasing hormone levels in association with postpartum depressive symptoms. Depress Anxiety. 2016; 33 (11): 1023-30.
21. Achmad LN, Sirait BI, Semen GM. The relationship between stress levels and menstrual cycle regularity in students of the Faculty of Medicine, Universitas Kristen Indonesia, class of 2017. Inter J of Med and Heal Res. 2021; 7 (8): 74-9.