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Original Article

Obstetrics and Gynaecology Section

Post-COVID-19 Menstrual Abnormalities among Medical Students at a Tertiary Care Medical College in Southern India: A Cross-sectional Study

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ABSTRACT

Introduction: The emergence of Coronavirus Disease-2019 (COVID-19) caught the world by surprise, leading to a widespread global pandemic that has had profound and distressing effects on various levels. Its impact has been far-reaching, causing severe consequences that continue to unfold. COVID-19 is a multisystem inflammatory disease involving all organs, including the female reproductive system.

Aim: To determine the prevalence of COVID-19 among students and compare post-COVID-19 menstrual abnormalities in the home and hospital groups.

Materials and Methods: A cross-sectional study was conducted to assess post-COVID-19 menstrual abnormalities among medical students at Department of Obstetrics and Gynaecology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, in southern India from April to December 2022. A total of 600 medical students were approached, and 549 responded, among whom 258 students were reported as COVID-19 positive and 291 reported as COVID-19 negative. After excluding risk factors, 204 COVID-19 positive students were selected as the study population. Data were collected using a prevalidated questionnaire. The COVID-19 study population of 204 (100%) was further stratified into two groups based on the treatment taken at home 162 (79.4%) or in the hospital 42 (20.5%). Chi-square test and Fisher's-exact tests were used to compare post-COVID-19 menstrual abnormalities, including cycle length abnormalities, Heavy Menstrual Bleeding (HMB), dysmenorrhoea, Premenstrual Syndrome (PMS), and hypomenorrhoea.

Results: The prevalence of COVID-19 in the study population was 204, accounting for 37.15% of the total population 204/549. Out of the 204 students, 162 (79.4%) received home treatment, and 42 (20.5%) received hospital treatment. Post-COVID-19 menstrual cycle abnormalities were more prevalent in the hospital group 26/42 (61.9%) than in the home treatment group 76/162 (46.9%). The most common abnormality in both groups was PMS, with a prevalence of 21 (50%) in the hospital group and 38 (23.4%) in the home group. In the home group, 37 (22.8%) experienced longer cycles, 33 (20.3%) had dysmenorrhoea, and 19 (11.7%) had shorter cycles. In the hospital group, 14 (33.3%) had longer cycles, 13 (30.9%) experienced dysmenorrhoea, and 9 (21.4%) had shorter cycles. HMB was reported by 6 (14.2%) in the hospital group and 13 (8%) in the home group, while hypomenorrhoea occurred in 11 (6.7%) in the home group and 5 (11.9%) in the hospital group. A significant association (p=0.001) was found between the COVID-19 treatment groups and PMS. However, for other post-COVID-19 menstrual abnormalities, such as cycle length, dysmenorrhoea, HMB, and hypomenorrhoea, there was no significant association between these abnormalities and COVID-19 treatment groups.

Conclusion: Post-COVID-19 menstrual abnormalities were more frequently observed in the hospital group compared to the home group. All post-COVID-19 menstrual irregularities resolved within six months, except for PMS.

Keywords: Coronavirus disease-2019, Dysmenorrhoea, Female reproductive system, Heavy menstrual bleeding, Home treatment, Hospital treatment, Hypothalamic pituitary adrenal axis, Premenstrual syndrome, Stress

INTRODUCTION

The emergence of COVID-19 took the world by surprise, resulting in a global pandemic that has caused immense stress and had far-reaching consequences. Its impact has been devastating, affecting individuals, communities, and nations on a significant scale [1]. COVID-19 is a multisystem inflammatory disease, and it has been postulated that these menstrual abnormalities are mainly due to either the direct effect of COVID-19 on the reproductive system or indirectly via stress and its effects on the Hypothalamic-pituitary-adrenal (HPA) axis [2]. These two factors are further discussed.

Due to stress: COVID-19 infection is associated with disturbances in the cytokine milieu in the body, leading to stress. Stress is a condition characterised by a disruption in both the physical and psychological equilibrium of an individual. When faced with stressful stimuli, the body undergoes a series of intricate physiological responses, engaging interconnected pathways such as the neuroendocrine systems. Among these pathways, the HPA axis plays a crucial role, triggering the release of cortisol at elevated levels, which can adversely impact various bodily functions [3]. Additionally, stress can also disrupt the body's natural immune response through the activation of the HPA axis and the Sympathetic-adrenal-medullary (SAM) axis [3]. The menstrual cycle is a multifaceted process that relies on intricate interactions among different tissues, hormones, and organ systems. It is influenced by both internal factors within the body and external factors, such as infections and lifestyle changes. With the global COVID-19 pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) surpassing two years, there is a growing curiosity about comprehending the post acute Sequel of SARS-CoV-2 (PASC) that occurs after infection [4].

It is well-established that emotional and psychological factors can influence and disrupt the regularity and pattern of menstruation [5]. Research findings have indicated that the extent of stress and anxiety induced by the COVID-19 pandemic has reached levels significant enough to influence the characteristics of the menstrual cycle in women [6]. Research has demonstrated that depression and anxiety disorders can disrupt the regulation of the HPA axis, thereby potentially impeding the surge of Luteinising Hormone (LH) and resulting in ovarian dysfunction [7]. The impact of stress on the Hypothalamic-pituitary-gonadal (HPG) axis can lead to disruptions in the regulation of key components such as Gonadotropin-releasing Hormone (GnRH), gonadotrophs, and the gonads themselves [8].

During periods of distress, the body releases cortisol, which can hinder the secretion of GnRH. This decrease in GnRH secretion subsequently results in reduced levels of Follicle Stimulating Hormone (FSH), LH, impaired follicular development, and diminished oestrogen secretion [9]. These modifications can give rise to anovulation and functional hypothalamic amenorrhoea, characterised by the absence of ovulation and irregular menstrual cycles. Furthermore, psychological distress has been linked to the exacerbation of dysmenorrhoea (painful menstruation) and HMB [10,11].

Due to COVID-19 infection: Infection with SARS-CoV-2 has the potential to directly influence the functioning of the hypothalamic-pituitary-ovarian-endometrial axis, leading to alterations in the menstrual cycle. Severe cases of COVID-19 can result in hypothalamic hypogonadism, a condition that may temporarily disrupt the menstrual cycle, causing amenorrhoea (absence of menstruation) and infrequent menstrual periods [12]. Angiotensin-converting Enzyme 2 (ACE2) receptors exhibit widespread expression in both the ovaries and endometrium [13,14]. This expression pattern raises the possibility that direct infection with SARS-CoV-2 could impact ovarian hormones and provoke endometrial responses, ultimately resulting in disruptions to the menstrual cycle [15].

Extensive research supports the notion that the heightened production of prostaglandins, including PGF2a and PGE2, plays a significant role in the development of dysmenorrhoea. These prostaglandins are primarily responsible for inducing increased uterine contractions, which are recognised as the primary cause of the pain associated with this condition [16]. There is a hypothesis suggesting that COVID-19 is also causing dysmenorrhoea through a similar mechanism, which needs further research.

A research study has been conducted to assess the influence of the COVID-19 pandemic and periods of quarantine on the mental well-being of women, as well as the potential effects on their menstrual patterns [17]. Nevertheless, the majority of these studies focused on the general population, excluding individuals who had confirmed direct infection with COVID-19. Consequently, the present study aimed to examine the occurrence of post-COVID-19 menstrual abnormalities specifically among students who had a history of testing positive for COVID-19 through Real-time Reverse Transcription-Polymerase Chain Reaction (RT-PCR).

MATERIALS AND METHODS

This was a cross-sectional study conducted among 600 medical students at Department of Obstetrics and Gynaecology, NRI Institute of Medical Sciences, Visakhapatnam, Andhra Pradesh, India to assess post-COVID-19 menstrual abnormalities using a questionnaire. Institutional Ethical Committee approval was obtained (reference No IEC/NRI/33/2022). The questionnaire assessment period was between April 2022 and December 2022. This period was selected as it coincided with the end of the third wave of the pandemic in India, allowing the authors to assess post-COVID-19 abnormalities from the beginning of the pandemic to the end of the third wave in India. The COVID-19 study population was stratified into two groups based on the treatment received, either at home or in the hospital.

Inclusion criteria: The study included students who tested positive for COVID-19 infection (RT-PCR). The age group was between 18-25 years, and the participants were unmarried. Only students with regular menstrual cycles and without pre-existing medical conditions such as diabetes, hypothyroidism, or Polycystic Ovarian Disease (PCOD) were included. Students who were not taking Oral Contraceptive (OC) pills were also included.

Exclusion criteria: Students who tested negative for COVID-19 infection were excluded from the study. Additionally, students outside the age range of <18 years or >25 years and married students were excluded. Students with irregular menstrual cycles and pre-existing medical conditions such as diabetes, hypothyroidism, or PCOD were also excluded. Students who were taking Oral Contraceptive (OC) pills were not included in the study.

Study Procedure

The questionnaire comprised three sections, as follows:

1) **Personal information and demographic details:** This section included student number, age, residence (urban/rural), socio-economic status using the modified BG Prasad scale [18], height, weight, Body Mass Index (BMI), and marital status (married/unmarried) [Table/Fig-1].

Serial no.	Demographic parameters	Mean±SD/frequencies		Percentage
1	Age (years)	21.39±1.95		
		18-20	58	(28.44%)
		21-25	146	(71.56%)
2	Residence	Urban	75	36.7%
		Rural	129	63.3%
		Total	204	100%
3	Socio-economic status (according to modified BG Prasad scale)	Class-1	182	89.2%
		Class-2	19	9.32%
		Class-3	3	1.48%
		Class-4, 5	Nil	Nil
		Total	204	100%
4	Height (cm)	157.18±6.97		
5	Weight (kg)	53.5±9.88		
6	BMI kg/cm^2	21.42±3.57		
7	Marital status	Unmarried	204	100%

[Table/Fig-1]: Social demographic data.

2) **History of reproductive health and menstrual patterns and past medical history:** This section included age at menarche (onset of first menstruation), menstrual cycles (regular/irregular), duration of menstrual bleeding (<3 days, 3-7 days, >7 days), amount of bleeding (mild/moderate/severe), presence of clots, association with pain, history of diseases such as diabetes, Polycystic Ovarian Syndrome (PCOD), hypo/hyperthyroidism, hypertension, psychiatric disorders, history of using OC pills, and any other medication [Table/Fig-2].

3) **Section focusing on COVID-19:** This section included information on RT-PCR test results (positive/negative) and history of treatment taken at home or in the hospital. The questionnaire also assessed post-COVID-19 menstrual abnormalities [Annexure-I].

The menstrual abnormalities and their definitions used in the study are as follows:

- Duration of the menstrual cycle was categorised into three groups based on typical patterns in Asian women: shorter (less than 24 days), normal (24 to 38 days), and longer (greater than 38 days) [19].
- HMB was defined as menstruation that persisted for more than seven days and involved a blood loss exceeding 80 mL during a single menstrual cycle.

Serial no.	Parameters	Mean±SD/ frequencies		Percentage
1	Age at menarche	13.06±0.84		
2	Menstrual regularity	regular	204	100%
3	Days of bleeding	<3 days	12	5.88%
		3-7 days	192	94.12%
		>7 days	Nil	Nil
		Total	204	100%
4	Amount of bleeding	Mild	Nil	Nil
		Moderate	204	100%
		Severe	Nil	Nil
		Total	204	100%
5	H/o pre-existing diseases, using OC pills, irregular cycles	Nil		Nil

[Table/Fig-2]: Menstrual and past medical history.

- Dysmenorrhoea was defined as painful menstruation.
- Hypomenorrhoea was defined as a decreased amount of bleeding during menstruation.
- Metrorrhagia referred to bleeding in between menstrual cycles, while menometrorrhagia referred to excessive bleeding during menses and in between cycles.
- The diagnostic criteria established by the American College of Obstetrics and Gynaecology (ACOG) were used for the diagnosis of Premenstrual Syndrome (PMS). The ACOG criteria included six affective symptoms and four somatic symptoms, and to diagnose PMS, atleast one affective symptom and one somatic symptom should be reported within five days before the start of menstruation in the three preceding menstrual cycles, with symptom resolution within four days of the onset of menses [20].

STATISTICAL ANALYSIS

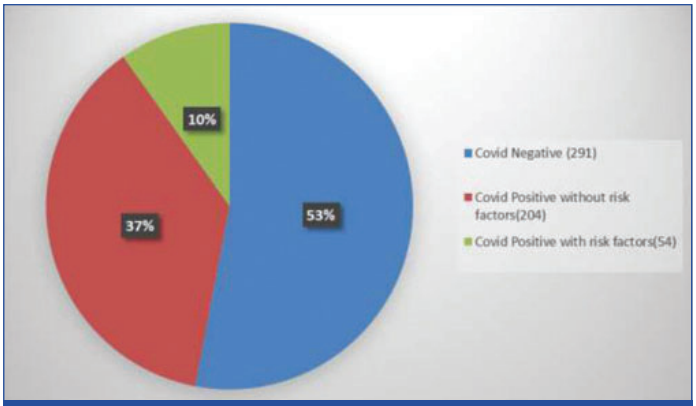
International Business Machine (IBM) Statistical Package for Social Sciences (SPSS) Statistics V.26 was used for statistical analysis to compare the various abnormalities among the students who received treatment at home or in the hospital. The Chi-square test and Fisher's-exact test were employed for this analysis.

RESULTS

In the present cross-sectional study, a total of 600 potentially eligible individuals were invited to participate. Among them, 51 individuals did not respond to the invitation, while 549 individuals willingly agreed to take part in the study. Out of the participants, 258 students reported being COVID-19 positive, and 291 students reported being COVID-19 negative [Table/Fig-3]. From the 258 COVID-19 positive cases, 54 students who had risk factors such as a history of irregular menstrual cycles, pre-existing medical disorders, or oral contraceptive pill usage were excluded according to the exclusion criteria. This step was taken to improve the quality of the study and eliminate confounding bias [Table/Fig-4]. After excluding these risk factors, a total of 204 students met the study criteria and were considered as the COVID-19 study population, which accounts for 37.15% of the total population. Within the present study population of 204 students, 162 (79.4%) received home treatment, while 42 (20.5%) received hospital treatment. None of the patients had any diseases such as diabetes, PCOD, hypo/hyperthyroidism, hypertension, or psychiatric disorders, and none of them were using any medication or oral contraceptives.

Total population (n)		COVID-19 (positive)		COVID-19 (negative)	
N	%	n	%	n	%
549	100	258	46.99	291	53.01

[Table/Fig-3]: Total population divided into COVID-19 positive and COVID-19 negative.



[Table/Fig-4]: Distribution of COVID-19 negative and COVID-19 positive with and without risk factors.

The occurrence of post-COVID-19 menstrual cycle abnormalities was higher in the hospital group, with a total of 26 (61.9%) compared to the home treatment group with 76 (46.9%). The most prevalent post-COVID-19 menstrual abnormality observed in both groups was PMS, with a prevalence of 21 (50%) in the hospital group and 38 (23.4%) in the home group [Table/Fig-5]. Dysmenorrhoea was observed more frequently in the hospital group, with 13 (30.9%) cases compared to 33 (20.3%) cases in the home group. HMB was also more common in the hospital group, with 6 (14.2%) cases compared to 13 (8%) cases in the home group. Hypomenorrhoea was observed in 11 (6.7%) cases in the home group and 5 (11.9%) cases in the hospital group [Table/Fig-5]. Other menstrual abnormalities such as metrorrhagia and menometrorrhagia were not observed in the present study and were therefore excluded.

Menstrual parameters	Home treatment (n=162)	%	Hospital treatment (n=42)	%
1. Cycle length				
<24 days	19	11.7	9	21.4
24-38 days	106	65.5	19	45.2
>38 days	37	22.8	14	33.3
2. Heavy Menstrual Bleeding (HMB)	13	8	6	14.2
3. Dysmenorrhoea	33	20.3	13	30.9
4. Amenorrhoea (cessation of menstruation)	24	14.8	10	23.8
5. PMS	38	23.4	21	50
6. Hypomenorrhoea	11	6.79	5	11.9
7. Overall change*	76	46.9	26	61.9

[Table/Fig-5]: Various post-COVID-19 menstrual abnormalities in hospital and home treatment groups.
*Among home group 76 (46.9%) students had one or the other above mentioned symptoms and among hospital group 26 (61.9%) students had one or the other above mentioned symptoms

There was a significant association (p=0.001) between the COVID-19 treatment groups and PMS [Table/Fig-6]. The p-value for the association between the place of treatment for COVID-19 positive students and cycle length was 0.050, with a Chi-square test statistic value of 5.975. As the p-value is not less than 0.05, there was no significant association between cycle length and the place of treatment [Table/Fig-6]. There was no substantial difference between the home and hospital groups regarding PMS behavioural symptoms (p=0.94) and somatic symptoms (p=0.88) [Table/Fig-7].

In terms of the duration since COVID-19 infection, within the timeframe of less than 3 months, a total of 158 students were included, out of which 102 had regular cycles and only 56 students had post-COVID-19 menstrual abnormalities (45 in the home group and 11 in the hospital group). Within the timeframe of 3-6 months, there were 34 students included (24 in the home group and 10 in the hospital group). For a duration of more than 6 months, there were 12 students included (seven in the home group and five in the hospital group) [Table/Fig-8].

Various abnormalities	Fisher's-exact Sig./Chi-square (2-sided) p-value	Odds ratio	95% Confidence interval	
			Lower	Upper
HMB	0.235	0.5235	0.1862	1.4716
Dysmenorrhoea	0.151	0.5707	0.2675	1.2175
PMS	0.001	0.3065	0.1513	0.6206
Hypomenorrhoea	0.331	0.5391	0.1765	1.6466
Cycle length	0.050	-	-	-

[Table/Fig-6]: Association between various abnormalities and place of treatment of COVID-19 positive students.
Fisher's-Exact Test used for HMB, Dysmenorrhoea, PMS, Hypomenorrhoea and Chi-square Test used for Cycle length

	PMS symptoms	Home (n=38)	%	Hospital (n=21)	%	Chi-square	p-value
I. Behavioural	1. Irritability	19	50	12	57.1	0.728	0.9478
	2. Depression	12	31.5	07	33.3		
	3. Angry outbursts	09	23.6	04	19.04		
	4. Anxiety	07	18.4	06	28.5		
	5. Confusion	04	10.5	03	14.28		
	6. Social withdrawal	-	-	-	-		
II. Somatic	7. Breast tenderness	13	34.2	09	42.8	0.6632	0.8818
	8. Abdominal bloating	08	21.05	03	14.28		
	9. Headache	22	57.8	12	57.14		
	10. Swelling of extremities	06	15.78	04	19.04		

[Table/Fig-7]: PMS symptoms in home and hospital groups (In this home and hospital group each student had 1 or more symptoms).

Post-COVID-19 menstrual abnormalies duration	Home	%	Hospital	%
<3 months	45	59.21	11	42.3
3-6 months	24	31.57	10	38.47
>6 months	7	9.22	5	19.23
Total	76	100	26	100

[Table/Fig-8]: Post-COVID-19 menstrual abnormalities duration in home and hospital group.

DISCUSSION

In the present study, the prevalence of post-COVID-19 menstrual abnormalities in the home group was 46.9%, which is consistent with the findings of Phelan N et al., who reported a 46% self-reported increase in menstrual cycle irregularities during the COVID-19 pandemic [21]. Similarly, in the hospital group, the percentage of post-COVID-19 menstrual abnormalities (61.9%) closely aligns with the study by Muharam R et al., where they observed menstrual abnormalities in 59% of women [22]. The present study revealed a higher incidence of post-COVID-19 menstrual abnormalities in the hospital group compared to the home group. These differences may be attributed to factors such as the duration of isolation, hospitalisation, and the severity of the infection itself.

In the present study, the authors identified PMS as the most frequently observed post-COVID-19 menstrual abnormality in both groups. This finding highlights how COVID-19 has had a greater impact on individuals' mental health than their physical well-being. Two independent studies have supported this finding, indicating that women experienced more pronounced forms of PMS during the COVID-19 pandemic [21,23]. In both the home and hospital groups, the most commonly observed PMS behavioural symptoms were irritability and depression. The most commonly observed PMS somatic symptoms were headache and breast tenderness. One of the aforementioned studies found that 84% of women reported experiencing atleast one symptom associated with a mental health disorder, with prevalent symptoms including low mood, anxiety, and disrupted sleep [21].

In the present study, post-COVID-19 menstrual cycle length changes were observed in the home group (11.7% shorter cycles and 22.8% longer cycles) and in the hospital group (21.4% shorter cycles and 33.3% longer cycles). Among the students experiencing longer cycles, 24 (14.8%) in the home group and 10 (23.8%) in the hospital group reported missed periods (amenorrhoea) for one or more months, which subsequently recovered within six months of COVID-19 infection. A study conducted by Li K et al., found that the occurrence of complications and severe illness was associated with an extended duration of the menstrual cycle [24]. The expression of ACE-2 receptors in the ovaries suggests that SARS-CoV-2 might directly influence the production of menstrual hormones. Additionally, severe illness resulting from infections, including COVID-19, could potentially induce hypothalamic hypogonadism, leading to menstrual irregularities such as amenorrhoea and infrequent menstruation [12]. These abnormal hormonal patterns, involving FSH, LH, estradiol, and progesterone, which collectively regulate menstrual patterns, have the potential to disrupt and influence the length of the menstrual cycle [25]. Interestingly, a shorter menstrual cycle was linked to an earlier surge in FSH and elevated levels of estradiol, while a longer menstrual cycle was associated with higher levels of LH and lower levels of estradiol [26].

In the present study, dysmenorrhoea was observed more frequently in the hospital group, with 13 (30.9%) cases compared to 33 (20.3%) cases in the home group. HMB was also more common in the hospital group, with 6 (14.2%) cases compared to 13 (8%) cases in the home group. Hypomenorrhoea was seen in 11 (6.7%) cases in the home group and 5 (11.9%) cases in the hospital group. It is hypothesised that SARS-CoV-2 impacts female fertility by interacting with the Angiotensin-converting Enzyme 2 (ACE2) [27]. ACE2 exhibits significant expression in the ovaries, where it plays a crucial role in regulating follicular development, ovulation, luteal angiogenesis, and influencing cyclic changes in endometrial tissue [28]. The potential impact of SARS-CoV-2 on female fertility arises from its potential to cause damage to ovarian tissue and granulosa cells [29]. The administration of steroids has been significant in the management of hospitalised patients with COVID-19 [30]. It is plausible that steroid usage could act as a risk factor for menstrual alterations in individuals with COVID-19, potentially influencing menstrual cycle patterns and blood loss through their impact on cortisol levels [31].

Limitation(s)

The present study is a retrospective cross-sectional study, which is more prone to recall bias. We did not differentiate post-COVID-19 menstrual abnormalities based on specific COVID-19 strains.

Additionally, we were unable to distinguish whether post-COVID-19 menstrual abnormalities were attributed to the disease itself and its effects on the Hypothalamic-pituitary-ovarian (HPO) axis or due to stress on the Hypothalamic-pituitary-adrenal (HPA) axis.

CONCLUSION(S)

In the present study, post-COVID-19 menstrual abnormalities were more frequently observed in the hospital group than in the home group. It is important to note that all post-COVID-19 menstrual abnormalities resolved within six months, except for PMS. A regular menstrual cycle is considered an indicator of overall good health, while disruptions in the menstrual cycle may suggest the presence of underlying abnormal conditions. COVID-19 has been found to cause temporary changes in the menstrual cycle, with the exception of PMS. This emphasises the significance of providing psychological support not only during the infection but also in the post-COVID-19 period to enhance women's mental health. Healthcare practitioners should assess women's mental health during and after COVID-19 and refer them for psychological support, when necessary.

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[ANNEXURE-I]

1. Serial no.
2. Age.
3. Residence: urban/rural.
4. Socio-economic status.
5. Height.
6. Weight.
7. BMI.
8. Marital status: married/unmarried.

Menstrual history section

09. Age at menarche (onset of first menstruation).
10. Mensrual cycles-Regular/Irregular.
11. Days of bleeding-<3 days.
    3-7 days.
    >7 days.
12. Amount of bleeding-mild/moderate/severe.
13. Presence of clots-yes/no.
14. Associted with pain yes/no.

Past medical history

15. Are you having any diseases like Diabetes, PCOD, Hypo/Hyperthyroidism, hypertension, h/o psychiatric disorders and taking medication etc.
    If yes mention the disease.
16. Are using any medication-yes/no.
17. Are using OC pills?.

COVID-19 Section

Have you ever been tested RT-PCR positive for COVID-19-yes/no.

If yes treatment taken/not.

If treatment taken-At home/Hospital.

At home-oral medication taken/not.

At hospital-ward treatment/ICU treatment.

Have you ever experienced any menstrual changes after COVID-19 (yes/no).

1. HMB/Menorrhagia: (increase bleeding during menstruation)
2. Cycle length.
   <24 days.
   24-38 days.
   >38 days.
3. Amenorrhoea (cessation of menstruation).
4. Dysmenorrhoea (pain during menstruation).
5. Hypomenorrhoea (decreased flow during menstruation).
6. Metrorrhagia (bleeding in between menstrual cycles).
7. Menometrorrhagia (excessive bleeding during menses and in between cycles).
8. PMS.

Have you ever been suffered from any of these behavioural symptoms during the last 14 days of menstrual cycle and relieved after menstruation?

i. Irritability.
ii. Depression.
iii. Angry outbursts.
iv. Anxiety.
v. Confusion.
vi. Social withdrawal.

Have you ever been suffered from any of these physical symptoms during the last 14 days of menstrual cycle and relieved after menstruation?.

vii. Breast tenderness.
viii. Abdominal bloating.
ix. Headache.
x. Swelling of extremities.

If yes, how many months are these symptoms lasted after COVID-19?.

Are these symptoms recovered or not?.

If recovered, within how many months/years_.