Impact of COVID-19 Vaccination on Menstrual Cycle, Quality of Life and Perception on Fertility: A Mixed Methods Study of Women in Delhi-NCR

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ABSTRACT
The COVID-19 pandemic presented extraordinary challenges which led individuals to make global efforts to develop a vaccine that could help battle the spread of the infection. The COVID-19 vaccine came as a sigh of relief for the world, but whilst we assess the positives, we must consider looking into the potential impacts it has had on aspects of health, including female reproductive health. The current study aimed at assessing the potential impacts that COVID-19 vaccination had on menstrual cycles and the perception of women about fertility-related issues following the jab through a comprehensive mixed methods design. A structured survey, using the Menstrual Symptom Questionnaire (MSQ) and WHO Quality of life scale was carried out with a diverse sample (n=500) of women (18-40 years) in the Delhi-NCR region, collecting data on menstrual cycle changes post receiving the Vaccine. Additionally, semi-structured interviews were conducted with a subset of the participants (n=15) to understand the perceptions of women about fertility-related issues following the Vaccine. The study suggests that most of the participants reported facing menstrual concerns such as missed periods, menstrual irregularities, excessive menstrual bleeding and increased cramping on the first day of their period. Through semi-structured interviews, the themes that emerged were fear regarding conception, early menopause, infertility, mood changes, anxiety, fatigue, less pain tolerance and problems with menstrual flow. Alongside, many had low scores on the quality-of-life questionnaire which was understood better through semi-structured interviews. Cognitive distortions were observed among participants while they explained their perceptions of the whole scenario. The study seeks to address a critical topic and fill knowledge gaps to understand the possible health impacts the COVID-19 vaccine has on women's reproductive health. The study would contribute to creating scientific evidence and valuable insights for the health industry to understand any potential side effects the vaccine could have.

1. Introduction

The Pandemic Surge and the Urgency of Vaccines

In the last few years, the impact of COVID-19 infection has been profound, and it shook the world through the enormous challenges it created. Billions of humans were directly and indirectly impacted which made it one of the most destructive and fatal in entire history.[1]

In India, by April 2020, the number of infected individuals began to increase rapidly and by June the virus began spreading aggressively. The mark of 1 million cases was reached by July 17 in India and it jumped to 2 million in roughly 3 more weeks, precisely the next 16 days to jump to 3 million and scarily only the next 12 days to surpass the mark of 4 million cases in the beginning of September.[2] The infections ranked the second highest around the globe by mid-week of September while recording the third-highest fatality rate of over 75,000 deaths.

The alarming situation motivated researchers and scientists around the world to come together and develop COVID-19 Vaccinations in the very first year since the first case was recorded, and the vaccination presented promising results in addressing the challenges presented by the pandemic.[3] On the 3rd of January, 2021, the General of the Drugs Control, India granted emergency consent for the two vaccinations namely, Covaxin and Covishield for controlled usage in light of the crisis caused by the pandemic despite its pending phase 3 clinical trial.[4]

The Lancet (January 2021) published data regarding Covaxin's clinical testing during Phase 1 which stated the effectiveness of the vaccine in generating the required immune response but suggested further trials to warrant the data. On the contrary, researchers and scientists have flagged concerns regarding both vaccines and believe that the vaccines were given a go-ahead for usage in haste before finishing the third phase of Clinical trials. This raised an issue regarding the effectiveness of the vaccines in producing the appropriate level of immune

response and demanded a deeper awareness of the possible ill effects of the vaccine.[5]

Common Side-effects of the COVID-19 Vaccination

Vaccines have been found to offer promising results in helping humans grow a strong and enduring immune response towards deadly and contagious diseases. Vaccinations help prevent approximately 2-3 million fatalities per year.[6] However, it still becomes important to address any side effects the vaccination could cause.

Multiple research projects have highlighted some commonly experienced side effects after receiving the COVID-19 vaccine such as mild to moderate fever and soreness at the injection site. A few serious and alarming side-effects caused that have come to awareness are developing cardiovascular issues such as strokes and blocked regions of the heart leading to heart attacks.[7] A study[8] was carried out on healthcare workers in Ethiopia to understand side effects experienced by them post receiving the COVID-19 vaccine. The side effects that were brought to awareness were very similar to other literature reviewed such as fever, tiredness, soreness at the injection site, headaches and feeling nauseous. Similarly, a longitudinal study[9] assessed the post vaccination adverse effects for both the Indian vaccines i.e., Covaxin and Covishield. The study reported that the most experienced post effect of receiving Covaxin was soreness on the injection site and fever for Covishield.

Apart from the commonly reported side-effects of the vaccine, few lesser known and spoken about post COVID-19 vaccination effects are kidney diseases, neurological and cognitive deficits, cardio-vascular issues, auto-immune disorders, skin related disorders such as urticaria and even anemia.[10]

Lately, research has also surfaced regarding disturbed menstrual patterns and irregularities such as modified duration of the cycle, menstrual span, difference in flow, painful menstruation and unusual spotting or bleeding from the uterus.[11]

Does COVID-19 Vaccination impact menstrual cycles?

Experiencing a regular menstrual cycle every month is equated to a positive indicator of overall health of women and referred as a “integral and critical indicator” by medical practitioners and the National Institute of Health, USA.[12,13] Encountering any unusual and unexplained changes in the menstrual cycles can be stressful and concerning for women.[14] The media and news has flagged concerns regarding probable relation between disturbed menstrual cycle patterns and the COVID-19 Vaccination. There have also been hypothetical statements and claims about the vaccine impacting the fertile potency of females which has raised the issue of vaccine hesitancy in many countries.[15]

The scientists and researchers overlooked the aspect of menstrual issues during the trial phases of the COVID-19 vaccination development.[16,17] Apprehensions have been raised among scientists, healthcare sector, and medical practitioners as they are unable to counter questions and issues of the public regarding the vaccine’s possible impact on menstrual cycles. Biologically, research has suggested that there is a relationship between receiving a vaccine and impacted menstrual cycles. The immune response expected from vaccines against diseases could interfere with menstrual cycles. Production of cytokines post the vaccine could progressively meddle with the hypothalamus-pituitary gland-ovarian circuit activity that is responsible for regulation of menstrual cycles each month.[18] It could also possibly trigger production of immune cells in or around the endometrium wall in the uterus which could interfere with tissue repairing process and lead to more bleeding than usual.

Multiple studies have surfaced from various nations which reported menstrual cycle changes post receiving the COVID-19 vaccination. Some menstrual irregularities reported post receiving the COVID-19 vaccine across studies are changed length of the cycle and difference in flow.[19,20,21] The frequency of menstrual disturbances observed across different countries in literature varied from 24.8% to 78%.[22,23]

An exploratory study[24] carried out in Turkey to understand whether COVID-19 vaccination influenced menstrual cycles of women reported that out of the 586 women included in the study, a huge percentage of more than half encountered menstrual difficulties. Thirty percent of females experienced late beginning of their cycle and twenty three percent experienced more days of menstrual flow than usual. A significant difference was reported in delayed periods/ shorter cycles, more days of menstrual flow and a heavier flow in women post receiving the COVID-19 vaccine in comparison to prior receiving the vaccine. A similar study[25] conducted in Spain reported more or less the same results except that women experienced more painful periods than usual and fewer days of menstrual flow.

Individuals who received Covishield and Covaxin have also reported experiencing disturbance in their menstrual cycles in a study[26] conducted in India for women in their reproductive age. The study however, found that 94.7% of its total participants did not experience change in the menstrual flow during their cycles. The authors of the study have not attempted to find any relationship between disturbed menstrual patterns and overall well-being of the females post receiving the vaccine. Nevertheless, a study[27] conducted in Peshawar has attempted to assess whether menstrual disturbances post receiving the COVID-19 Vaccine has impacted the mental health of medical students. The study found through thematic analysis that a huge percentage (82.4%, n=14) of the participants expressed feeling a disturbed state of their mental health due to changes in their menstrual cycles.

Rationale of the study

COVID-19 Vaccination in India was given a go ahead for use before its final clinical trial due to the alarming situation and challenges that the growing number of cases had presented to the medical practitioners and healthcare industry. Due to which the possible impact the vaccine has had on different aspects of health have been a reasonable topic for extensive research and probes. Additionally, according to a study[28] and Duke Global health institute[29], novel viruses such as the Coronavirus are found frequently emerging among the human population which would increase the occurrence of more pandemics and epidemics. The possible rise in pandemics makes it increasingly important for researchers and scientists to consider the impact of vaccines (during their development phase) on the menstrual health of the female population. The highlighted aspect catching attention lately by media and news is the possible impact of the COVID-19 Vaccination on menstrual cycles and whether there is a potential correlation between menstrual cycle changes and overall wellbeing on individuals. Through a mixed-method approach, the current study would help develop a better insight of menstrual cycle changes if any faced by women, personal experiences, their perceptions about how the vaccine could impact fertility and how any menstrual disturbances impacted their well-being. Results from this study could also help medical practitioners such as gynaecologists and physicians address any misconceptions which could help relieve distress among women and also spread awareness regarding taking informed decisions about the vaccine. Additionally, the study would help researchers and scientists to explore the topic more with further research.

Research Questions

The research was designed based on the following research questions:

- Is there any possible impact of COVID-19 vaccination on menstrual cycles of women residing in Delhi-NCR?
- What are the perceptions and beliefs that women have regarding fertility post the COVID-19 vaccine and potential reasons influencing these perceptions?
- Is there any relationship between menstrual cycle changes post the vaccine and overall well-being of women?

Objectives of the study

The objectives of the current study are as follows:

- To explore the impact of COVID-19 vaccine on menstrual cycle patterns of women residing in Delhi-NCR.
- To understand the perception and beliefs of women regarding the impact of the COVID-19 vaccination on fertility.
- To explore any possible correlation between menstrual cycle changes/ disturbances and well-being of women.

2. Method

The current study employed an exploratory sequential mixed methods approach to understand the impact of COVID-19 Vaccination on menstrual cycles, quality of life and perception of women on Fertility post the COVID-19 Vaccine. The study population was 500 women in the age bracket of 18-40 years residing in Delhi-NCR. The females who were included had no prior menstrual concerns and issues prior to the Vaccination.

The participants were chosen for the study through a convenience and snowball sampling method. The demographic details that were included for the study were their marital status, age, level of education and name of vaccine received. For the quantitative part of the study, Menstrual symptom questionnaire[30] and WHO Quality of life scale[31] were administered on women which was followed by semi-structured interviews with 15 women for the qualitative part of the study.

Ethical Guidelines

Individuals were asked to consent to their participation in the study through an informed consent form which stated guidelines of confidentiality and privacy for their identity and data.

3. Results

The SPSS software was used to perform the quantitative analysis for the study whereas for the qualitative analysis, the researchers used thematic analysis to draw out themes from the data obtained through semi-structured interviews.

The demographic details of the participants are given in detail in Table 1.1 below.

Table 1.1 Demographic Details of the participants

Socio-Demographic Characteristics	n	Percentage
Age (in years)		
18-26	357	71.4%
27-40	142	28.4%
Marital Status		
Married	234	46.8%
Unmarried	265	53%
Name of vaccine received		
Covishield	307	61.4%
Covaxin	147	29.4%
Others	45	9%
Education		
Grade 12	76	15.2%
Graduation	197	39.4%
Post-Graduation	190	38%
Others	36	7.2%

For the Menstrual Symptom Questionnaire, out of 500 women, 51.8% (n=259) women reported having menstrual cramps and stated they have been worse than they used to be before receiving the COVID-19 vaccination. Alongside, 65.2% (n=326) women reported that they preferred staying bed, using a hot water bottle, or taking a hot shower to ease the menstrual cramps. 40% (n=200) females also chose the option of "always" and "often" for experiencing irritation, agitation and restlessness many days before the cycle begins. Overall, 70.6% (n=353) women reported high composite scores on the menstrual health questionnaire, signifying changes in their cycle post receiving the COVID-19 Vaccine.

Pearson Correlation was performed to assess any possible relationship between menstrual symptoms and overall wellbeing. No correlation was observed between the two variables.

An independent sample t-test was performed to understand whether there was any difference between menstrual cycle changes encountered by women who received Covishield and Covaxin (Based on type of Vaccine received), women who belonged to different age groups and marital status. To see the difference in menstrual cycle changes dependent on age, women were divided into two groups i.e. 18-26 years and 27-40 years.

The results of the t-test (Vaccine wise) found significant differences in four different menstrual symptom scores and total menstrual symptom scores between women who received Covishield and Covaxin. Statistical differences were found on the scores of the items which were: "Taking a prescribed drug for menstrual pain and cramps during my cycle" ($t=-2.101$, $p>0.05$, $d=0.20$), "experiencing weakness and dizziness during their menstrual cycle" ($t=-2.072$, $p>0.05$, $d=0.26$), "experiencing back aches before menstrual cycle" ($t=-2.098$,

p>0.05, d=0.21), "experiencing nausea on the onset or so of the menstrual cycle" (t=-2.027, p>0.05, d=0.20). There was also a statistically significant difference (t=-2.249, p>0.05, d=0.22) found between the total score of the menstrual symptoms between women receiving Covishield and Covaxin. The results for the same have been explained in Table 1.2.

Table 1.2 Mean differences, t-test Values and Cohen's d for two sets of women (On the basis of the Vaccine received)

Variables	Type of Vaccine Received	n	Mean ± SD	t-value	p-value	Effect Size (Cohen's D)
Total Menstrual Symptoms Score	Covishield	307	66.34±14.172	-2.249	0.025**	0.22
	Covaxin	147	69.55±14.421			
Taking a prescribed drug for menstrual pain and cramps during my cycle	Covishield	307	1.69 ± 1.094	-2.101	0.036**	0.20
	Covaxin	147	1.93 ± 1.291			
Experiencing back aches before menstrual cycle	Covishield	307	3.19 ± 1.303	-2.098	0.036**	0.21
	Covaxin	147	3.40 ± 1.358			
Experiencing nausea on the onset or so of the menstrual cycle	Covishield	307	2.16 ± 1.270	-2.027	0.043**	0.20
	Covaxin	147	2.43 ± 1.380			
Experiencing weakness and dizziness during their menstrual cycle	Covishield	307	2.96±1.082	-2.702	0.07**	0.26
	Covaxin	147	3.25±1.091			

The independent sample t-test carried out to assess differences between menstrual cycle changes dependent on marital status suggested statistically significant results (t=-2.126, p>0.05, d=0.19) only for one item of the menstrual symptom questionnaire i.e. "experiencing nausea on the onset or so of the menstrual cycle". Unmarried females reported higher scores on the item as compared to married females post receiving the COVID-19 vaccination. The results for the same have been explained in Table 1.3 below.

Table 1.3 Mean differences, t-test Values and Cohen's d for two sets of women (On the basis of their marital status)

Variables	Marital Status	n	Mean ± SD	t-value	p-value	Effect Size (Cohen's D)
Experiencing nausea on the onset or so of the menstrual cycle	Married	211	2.11±1.239	-2.126	0.034**	0.19
	Unmarried	243	2.37±1.362			

The independent sample t-test carried out to assess differences between menstrual cycle changes dependent on age suggested statistically significant results (t=2.013, p>0.05, d=0.19) only for one item of the menstrual symptom questionnaire i.e. "Staying in bed, using a hot water bottle, or taking a hot shower to ease the menstrual cramps". Women in the age bracket of 18-26 years reported higher scores on the item as compared to women in the age bracket of 27-40 years post receiving the COVID-19 vaccination. The results for the same have been explained in Table 1.4 below.

Table 1.4 Mean differences, t-test Values and Cohen's d for two sets of women (On the basis of their age)

Variables	Age	n	Mean ± SD	t-value	p-value	Effect Size (Cohen's D)
Staying in bed, using a hot water bottle, or taking a hot shower to ease the menstrual cramps	18-26 years	327	3.92±1.259	-2.013	0.045**	0.19
	27-40 years	127	3.65±1.467			

A two-way ANOVA was performed to explore any possible interaction between the type of vaccine received and marital status of women on the menstrual symptoms. The results of the tests demonstrated significant main effect of two items of the menstrual symptom questionnaire i.e. "menstrual pains that appear and fade away for some time before they begin to be felt again" F(453)=6.956, p=0.009) and "experiencing nausea on the onset or so of the menstrual cycle" (F(453)=5.126, p=0.024) with type of vaccine received and marital status. The detailed results are given in Table 1.5.

Table 1.5 Two-way ANOVA results for type of vaccine received and marital status on menstrual symptoms.

Variables	df	Mean square	F	Significance
Two-way ANOVA on marital status and type of vaccine received.				
Menstrual pains that appear and fade away for some time before they begin to be felt again	1	8.773	6.956	0.009
Error	453			
Experiencing nausea on the onset or so of the menstrual cycle	1	8.598	5.126	0.024
Error	453			

A further analysis through independent sample t-test was performed to explore any differences between the two menstrual symptoms for which we found significant level of interaction and different type of vaccine received and marital status of women. Statistically significant results (t=2.524, p>0.05, d=0.41) were found for the item "menstrual pains that appear and fade away for some time before they begin to be felt again", when compared between married and unmarried women. Married women reported higher scores on the item.

Statistically significant results (t=-3.037, p>0.05, d=0.50) were found for the item "experiencing nausea on the onset or so of the menstrual cycle", when compared between married and unmarried women. Unmarried women reported higher scores on the item.

The two items of the menstrual symptom questionnaire were also compared to assess any differences based on type of vaccine received. The t-test results suggested statistically significant results (t=-3.026, p>0.05, d=0.40) for the item "experiencing nausea on the onset or so of the menstrual cycle". Women who received Covaxin had higher scores on the item. Whereas no significant results were found on the other item when compared on the type of vaccine received. Table 1.6 and Table 1.7 displayed the detailed results.

Table 1.6 Mean differences, t-test Values and Cohen's d for two sets of women (On the basis of their marital status)

Variables	Marital Status	n	Mean ± SD	t-value	p-value	Effect Size (Cohen's D)
Menstrual pains that appear and fade away for some time before they begin to be felt again	Married	211	3.15 ±1.178	2.524	0.013**	0.41
	Unmarried	243	2.66±1.181			
Experiencing nausea on the onset or so of the menstrual cycle	Married	211	2.09 ± 1.125	-3.037	0.03**	0.50
	Unmarried	243	2.77 ± 1.532			

Table 1.7 Mean differences, t-test Values and Cohen's d for two sets of women (On the basis of the vaccine received)

Variables	Type of Vaccine received	n	Mean ± SD	t-value	p-value	Effect Size (Cohen's D)
Menstrual pains that appear and fade away for some time before they begin to be felt again	Covishield	307	2.87 ±1.064	1.384	0.168	-
	Covaxin	147	2.66±1.181			
Experiencing nausea on the onset or so of the menstrual cycle	Covishield	307	2.20 ± 1.248	-3.026	0.03**	0.40
	Covaxin	147	2.77 ± 1.532			

Results from thematic analysis

The researchers conducted semi-structured interviews with 15 participants to understand the beliefs and perceptions of women about any menstrual changes encountered post the vaccine, views about fertility following the vaccine and coping strategies that they employ to deal with these challenges. The themes that emerged are as follows:

Theme 1: Changes in menstrual cycle post receiving the COVID-19 vaccination.

The common changes women reported were less pain tolerance (n=9, 60%), missed period (n=11, 73%), excessive menstrual flow (n=10, 66.6%), painful cramps before and on the first day of period (n=12, 80%). Few of the verbatim of participants is as follows:

“Exactly next month after receiving Covishield, I missed my period.”

“My pain tolerance has gone down massively, earlier it used to be very easy for me to carry out through my day but now I take multiple leaves.”

“For the first time after receiving the vaccine, I started to have clotting bleeding and it has been so heavy sometimes that I was advised to take iron supplements.”

Theme 2: Concerns regarding fertility issues.

Women expressed a fear of the possibility of not being able to conceive (n=12, 80%), vulnerability to miscarriages (n=8, 53.3%), early menopause (n= 11, 73%) and negative impact on progesterone levels (n=7, 46.6%).

“I never had a problem of missing my cycle before the vaccine but now I worry about whether it will also interfere with my family planning.”

“I have heard many women having miscarriages these days, it could be a side effect of the COVID-19 Vaccine.”

“My friend had a menopause at 38 and it worries me that the possible reason could be the vaccination.”

Theme 3: Seeking medical help.

Most of the women (n=12, 80%) expressed visiting their general physician and gynecologists for encountering painful cramps, taking progesterone tablets for missed periods (n=7, 46.6), taking painkillers for backaches and cramps (n=8, 53.3%) and seeking guidance from their doctor for nausea (n=11, 73%).

“I have started taking painkillers during the first two days of my cycle as my pain tolerance has become less and periods are more painful than earlier.”

“I missed my period for 2 months and my doctor put me on progesterone for 5 days before I finally could get my cycle.”

“It becomes so difficult to eat normally during my periods as I experience nausea most of the time now.”

Theme 4: Experiencing disturbed mental well-being.

Some of the women (n=8, 53.3%) expressed an anxious state of mind due to missed periods and heavy flow, few of them (n=9, 60%) were angry and regretted their decision of getting the vaccine due to such changes. The verbatim explains their state of mind well.

“I wish I could have just escaped the vaccine as it's causing more ill-effects than benefits.”

“There has been so much anxiety for me as I was planning for a baby this year but have rather been missing my period.”

Theme 5: Different ways of coping with stress and cycle changes.

Some women (n=7, 46.6%) expressed resorting to naturopathy/ayurvedic practices and treatments for their menstrual changes and also stress, practicing yoga to regulate their cycles (n=11, 73%), seeking therapy to relieve anxiety (n=8, 53.3%), talking to friends if they experienced same phenomena (n=12, 80%).

“I have started taking ayurvedic therapies and medicines to strengthen my uterus as I want to plan for a child.”

“Yoga has come to my rescue, and I've lost some weight which would also help in regulating my cycle.”

"I instantly spoke to my friends about whether they also were having similar concerns like mine.''

4. Discussion

The current study aimed at assessing the potential impacts that COVID-19 vaccination had on menstrual cycles and perception of women about fertility related issues following the jab through a comprehensive mixed methods design. A structured survey, using Menstrual symptom questionnaire (MSQ) and WHO Quality of life scale was carried out with a diverse sample (n=500) of women (18-40 years) in the Delhi-NCR region, collecting data on menstrual cycle changes post receiving the Vaccine. Additionally, semi-structured interviews were conducted with a subset of the participants (n=15) to understand perceptions of women about fertility related issues following the Vaccine.

The media has been raising concerns regarding probable relation between disturbed menstrual cycle patterns and the COVID-19 Vaccination. There have also been hypothetical statements and claims about the vaccine impacting the fertile potency of females which has raised the issue of vaccine hesitancy in many countries.[15] A lot of reports have been published that claim mixed views of doctors and other healthcare workers regarding the safety of the COVID-19 vaccines that have been continuously raising alarms for individuals.[32] It becomes increasingly important to address such concerning information and rule out any possible impacts that the vaccine could cause.

In the current study, 70.6% (n=353) women reported high composite scores on the menstrual health questionnaire, signifying changes in their cycle post receiving the COVID-19 Vaccine. Alongside, 51.8% (n=259) women reported having menstrual cramps and stated they have been worse than they used to be before receiving the COVID-19 vaccination. The results of the current study were similar to a systematic review[33] that also reported women experiencing more painful periods post receiving the vaccination. Inconsistent with the current study, a statement was released by the European Medical Agency[34] after their meeting on risk assessments of drugs that claimed that there was no relationship found between menstruation cycle and receiving the COVID-19 vaccine. One possible reason of experiencing heightened menstrual cramps post the COVID-19 vaccine could be the triggered immune system and disruption in the inflammatory responses quite similar to bodily's response to the typhoid and HPV Vaccine.[35]

To understand any difference in menstrual symptoms dependent on the vaccination received by women, an independent sample t-test was performed. There was a statistically significant difference ($t=-2.249$, $p>0.05$, $d=0.22$) found between the total score of the menstrual symptoms between women receiving Covishield and Covaxin. Women who received Covaxin displayed higher disturbance in their menstrual symptoms. Similar results were reported by another study[36] that suggested women who received Covishield reported significantly higher disturbance ($p=0.01$) in their menstrual abnormalities but were not very serious and usually settled within not more than three months. The study also suggests that the minor changes in the menstrual cycle do not account as a good reason for vaccine hesitancy. On the contrary another study[37] no significant relationship between menstrual cycle abnormalities based on the type of COVID-19 vaccine received by the participants. The possible reason for heightened menstrual disturbances experienced by Covishied recipients is explained by the difference in structural dynamics of the vaccine in a study[38] which suggests that Covaxin uses inactivated virus to help boost immune response of the body whereas Covishield comprises of modified viral vector leading to a stronger immune response of the body. The stronger immune response could explain hormonal imbalances leading to menstrual abnormalities such as heavy bleeding or longer/shorter cycle lengths.

Another finding of the current study was that unmarried females reported significantly higher scores on the item "experiencing nausea on the onset or so of the menstrual cycle" as compared to married women. A study conducted by Fallatah and colleagues[39], attempted to study whether there was any change in menstrual cycle experienced by women post receiving the COVID-19 vaccination. Out of 472 participants, 95.3% were unmarried. A total of 54.7% unmarried participants reported changes in their menstrual cycles. Sualeh and colleagues[40], conducted a similar study in Karachi, Pakistan which included marital status as a variable but did not highlight any significant differences in menstrual cycles in women based on their marital status.

Alongside, women in the age bracket of 18-26 years reported significantly higher scores ($t=2.013$, $p>0.05$, $d=0.19$) on the item, "Staying in bed, using a hot water bottle, or taking a hot shower to ease the menstrual cramps" as compared to women in the age bracket of 27-40 years post receiving the COVID-19 vaccination. A

cross-sectional study[41] carried out among a large sample of 4942 women in six Arab countries suggested that women experienced extremely painful periods, nausea, and more bleeding than usually experienced.

To fulfil the objective of assessing the relationship between any menstrual cycle changes/ disturbances and well-being of women, a Pearson correlation test was carried out and it suggested no correlation between the two variables. The results of the current study were contrary to a study[40] which reported that females who encountered changes in their menstrual cycle post the vaccine also reported moderate levels of stress which could be a contributing reason to experiencing disturbed menstrual cycles.

Another objective of the study, "To understand the perception and beliefs of women regarding the impact of the COVID-19 vaccination on fertility and reproductive health" was met through conducting semi-structured interviews with 15 women. The themes that emerged through thematic analysis were changes in menstrual cycle post receiving the COVID-19 vaccination, concerns regarding fertility issues, seeking medical help, experiencing disturbed mental well-being and different ways of coping with stress and cycle changes. A study[42] carried out to study the perceptions of women in their reproductive age regarding fertility in regard to the COVID-19 vaccine reported a theme of uncertainty about the impact of the vaccine on their future fertility. Some women also expressed feeling concerned regarding the impact of the vaccine on their reproductive health.

To assess interaction between the type of vaccine received and marital status of women on the menstrual symptoms a two-way ANOVA test was performed. A significant main effect of two items of the menstrual symptom questionnaire i.e. "menstrual pains that appear and fade away for some time before they begin to be felt again" $F(453)=6.956$, $p=0.009$) and "experiencing nausea on the onset or so of the menstrual cycle" ($F(453)=5.126$, $p=0.024$) with type of vaccine received and marital status. On further analysis, it was observed that married women reported higher scores on "menstrual pains that appear and fade away for some time before they begin to be felt again" and unmarried women and women who also received Covaxin reported higher scores on "experiencing nausea on the onset or so of the menstrual cycle". Whereas there was no difference on "menstrual pains that appear and fade away for some time before they begin to be felt again" based on the vaccine received.

The menstrual changes reported by women following the COVID-19 vaccination across various studies and the current one would provide important grounds for healthcare providers like gynaecologists to explore other possible precipitating and predisposing factors that could be leading to changes alongside the COVID-19 vaccination being one of the causes. The current literature is still inadequate leading to more apprehension among the layman population regarding the vaccine which makes studies like the current one clinically important as they could stop the mis spread of information and offer support to healthcare professionals to create more awareness regarding the possible impacts of the vaccine on the menstrual health of women.

5. Limitations

The current study has a good sample size (n=500) but the findings couldn't be generalised to the entire population of the Delhi-NCR due to varied socio-economic levels, level of education and urban, semi-urban and rural populations. The study should be repeated with a larger sample size and Hindi speaking population who have less qualifications than grade 12 as the minimum qualification we included was women who completed their 12th grade, and all were English literate.

Another possible limitation of the study is that the responses of the women could be influenced or impacted by the information received by these women through social media or news channel that could lead them into either over reporting their symptoms or under reporting as there is a lot of mis information, rumors and non-scientific information spread through these mediums.

Author Contribution

The first two authors contributed towards developing the methodology of the study and the third author has contributed towards the statistical analysis for the research.

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