

Studying the Effect of COVID -19 Pandemic on Female Reproductive cycle

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Abstract

Background: The COVID-19 pandemic has had far-reaching effects on various aspects of human life, including health and well-being. The effect of the covid19 pandemic on the female reproductive cycle. **Aim:** This study aimed to study the effect of covid19 pandemic on female reproductive cycle. **Methods:** A descriptive design was used to accomplish this study, which was carried out on 90 female patients at Homyate Tanta Hospital. Two tools were used in this study and classified as the following structured interviewing questionnaire, health assessment sheet. **Results:** most of the studied females have good pattern of reproductive system before and after Quarantine, respectively. While nearly two thirds of them have poor pattern during Quarantine. In addition, most of them have good total pattern **Conclusion:** Slightly more than three quarters of the studied hospitalized females had good level of total knowledge about Covid-19 preventive measures. As well, most of the studied hospitalized females had good pattern of reproductive system before and after Quarantine. While nearly two thirds of them had poor pattern during Quarantine. In addition, most of the studied females had average stress during Quarantine, nearly two thirds of them had low stress after Quarantine, and more than three quarters of them had average total stress levels. **Recommendations:** Raising women awareness regarding the effect of covid19 infection on their reproductive cycle.

Keywords

COVID-19, Female, Pandemic, Reproductive cycle

Introduction:

The COVID-19 pandemic, caused by SARS-CoV-2, has affected millions globally, resulting in serious mortality and morbidity. COVID-19 infection has caused serious health problems affecting all organs and systems, especially respiratory diseases. One of the conditions affected by the COVID-19 pandemic is the menstrual cycle in women (**Cucinotta & Vanelli, 2020**).

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, has transformed the world in unprecedented ways. Beyond the immediate health consequences, the virus's impact has rippled through various aspects of our lives, including our physical and emotional well-being. While much attention has rightfully been given to understanding the respiratory and systemic effects of COVID-19, there is a growing need to explore its impact on other bodily systems (**Davis et al., 2023**).

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The female reproductive cycle is a complex and delicately balanced system. It plays a fundamental role in women's lives, influencing their fertility, overall health, and emotional well-being (Muhaidat et al., 2022). The cyclical nature of reproductive health is tightly regulated by hormones, and any disruptions can lead to a cascade of physical and emotional consequences. Women's reproductive health is also intricately linked to their psychological and social well-being, as it often shapes important life decisions related to family planning and personal identity (Muharam et al., 2022).

Many factors that can affect menstrual cycles, such as stress, endocrine, gynecological, autoimmune, nutrition, genetics, infection, and changes in lifestyle. In many women, menstrual cycle irregularities were observed during the pandemic period. Recent studies, observed that SARS-CoV-2 infection, COVID-19 vaccines, and also stress in the pandemic may affect the menstrual cycle (Phelan et al., 2021).

SARS-CoV-2 infection may affect the hypothalamic-pituitary-ovarian-endometrial axis, resulting in hypothalamic hypogonadism, which may cause temporary menstrual irregularities. In addition, ACE-2 receptors are widely expressed in the ovaries and endometrium, suggesting that SARS-CoV-2 infection may cause menstrual irregularities by directly affecting the ovaries and endometrium. Menstrual changes have also been reported following COVID-19 vaccination, which may be attributed to immunological processes (Ozimek et al., 2022).

The nursing role in caring for females affected by COVID-19 during their menstruation is multifaceted and crucial for their well-being (Khan & Naushad 2020). Nurses should provide comprehensive women's health education to help them navigate this period with minimal disruptions and discomfort. Education includes advising women to maintain a balanced and nutritious diet, ensuring they consume foods that contain all essential health components. Encouraging simple exercises and adequate sleep is also vital for managing menstrual health. Furthermore, nurses should emphasize the benefits of staying hydrated with warm beverages and fostering personal hygiene practices. Safety precautions related to COVID-19 should be reinforced to protect both their general health and that of those around them. Nurses should also recommend monitoring menstrual flow and promptly reporting any abnormalities to their healthcare provider (Jaspher & Kavichelvi, 2021).

Significance of the study:

An immunocompromised state, as seen in menstruation with its physiological changes, lifestyle changes experienced by female throughout to COVID-19 pandemic. Lockdown period can impact menstrual cycle length and symptoms over half of all females reported a change in their cycle length and over third experienced changes in bleeding patterns (Odriozola-González et al., 2020).

The stress caused by the pandemic is the most significant contributor to menstrual cycle changes, consequences, with the current uncertainty of COVID-19 and possibility of second wave during winter season menstrual cycle changes could become a serious, it is

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important to educate female About the influence of stress and changes of menstruation to know the reason and overcome (Ammar et al., 2020).

Prevalence of COVID-19 in Egypt from Jan 3 to 1 March 2021 there have been 182,424 confirmed cases of COVID-19 with 10,688 death. Prevalence of COVID-19 in the Work is 113,820,168 confirmed cases and 2,527,891 death, American is 50,595,663 confirmed cause, European is 38,788,470 confirmed cases South-East Asia is 13,539,1796 confirmed cases, Eastern Mediterranean is 6,418,407 confirmed cases, Africa is 2,851,062 confirmed cases, Western Pacific is 1,626,642 confirmed cases (WHO, 2020).

The COVID-19 pandemic has caused major disruptions to daily life, imposing physical isolation, economic stress, healthcare access barriers, and psychological distress on populations Investigating the influences of an unprecedented global event like the COVID-19 pandemic on female reproductive function significantly advances understanding of women's health. Findings of the study enable evidence-based care to safeguard menstrual health now and during future periods of societal disruption.

Aim of the study

The aim of the study to study the effect of covid -19 pandemic on female reproductive cycle.

This aim is achieved through the following objectives:

1. Assess the knowledge of women towards preventive measure against COVID-19 pandemic before-during quarantine and after quarantine 3 months.
2. Assess the level of stress related to COVID-19 pandemic among hospitalized female during quarantine, and after 3 months.
3. Assess the effect of COVID-19 pandemic on the pattern of Female Reproductive cycle.

Research questions

Q1: Is the COVID-19 pandemic affect the Female Reproductive cycle?

Research Design

A descriptive design; it is a type of research methodology that aims to describe or document the characteristics, behaviors, attitudes, opinions, or perceptions of a group or population being studied.

Study Settings

The study was conducted in the Homyate Tanta Hospital which included four floors as first floor was emergency, second floor hepatic department and isolation ward, third floor for female department and ICU and last floor for male department. It includes 119 beds.

Sampling:

Type:

A convenience sampling

Sample size:

The estimated sample size is 90 hospitalized females

Subject:

90 hospitalized females affected with COVID-19 infection, the data was collected during quarantine and after 3 months according to the following criteria.

Inclusion criteria:

The Female age is ranged from 18-45 years the isolated hospitalized female with menstruation

Exclusion criteria:

1. lactating female.
2. Female had any Obstetrical, Gynecological, Medical, or surgical history.

Tools of data collection:

Two tools were used in this study and classified as the following:

Tools for data collection:

1st tool: Structured Interviewing Questionnaire:

It was designed by the researcher after reviewing related literature to collect the required data. It was written in simple Arabic language, and it consists of four parts.

Part I: Personal characteristics of hospitalized females such as age, residence, level of education and weight.

Part II: Knowledge assessment sheet: it developed by the researchers after reviewing the related literature (**Jing et al., 2020** and **Nazir et al., 2022**), that divided into three parts and included 23 questions at Arabic language. distributed three types:

- before quarantine: it included 7 questions as definition of covid 19, symptoms and sign precautionary against infection
- during quarantine: it included 8 questions as benefits of washing hand, benefits of maintaining distance to protect against infection.
- after recovery: it included 8 questions as maintained to wear mask, handwashing, follow precautionary method.

Scoring system:

The total scores of the 23 questions were 23 degree which equal 100%, each question was assigned a score according to hospitalized females' knowledge responses were correct answer scored with 1 and incorrect answer scored with 0. The hospitalized female knowledge was checked with a model key answer and accordingly the hospitalized females' knowledge was categorized into satisfactory and unsatisfactory.

- **Satisfactory** knowledge if total score from 50% - 60% or more
- **Unsatisfactory** knowledge if total score from <60%

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Part III: assessment the level of stress state of the patient during quarantine: It was adapted from **Muharam et al., 2022**, included 11 items and it was written in simple Arabic language as; suffer from psychological stress as a result of infection, feel during quarantine.... etc.

- Assessment the level of the stress state of the patient after recovery: It was adapted from **Muharam et al., 2022**, included 5 items as feel after recovery and it was written in simple Arabic language as; afraid of getting infected again, affected by the treatment of the medical staff with you.

Scoring system:

Each item was scored as 1 for yes and 0 for no. The total score of each female was categorized into “Low stress if score <50%”, and Average stress if score 50 to 70%”, and High stress if score >70%.

2nd tool: Heath assessment sheet: It was adapted from **Nguyen et al., 2021**, it included 28 items, distributed as data related to menstrual cycle before infection: It was adapted from **Aolymat et al., 2022** and included 10 items and it was written in simple Arabic language as the amount of the menstrual cycle, number of sanitary pads are used during the menstrual cycle per day.

- Also the researcher adapted another 18 questions for **Aolymat et al., 2022** to assess any changes of female reproductive cycle as a result of covid 19 infection this data was collected during, after quarantine. it was written in simple Arabic language as amount of menstrual cycle, severe pain associated with the menstrual cycle, suffer from any accompanying symptoms during the menstrual cycle, components of blood during the menstrual cycle after infection.

Scoring system:

Each item was scored as 0 for negative answer and 1 for positive answer. The total score of each female was categorized into “Low pattern <60%”, and High pattern if score 60% or more.

Validity:

The validity of the tools was done by three experts who interviewed the instrument for content accuracy and internal validity. Also, professors were asked to judge the items for completeness and clarity (content validity).

Reliability:

Reliability analysis by measuring of internal consistency of the tool through Cronbach's Alpha test.

Items	Cronbach alpha
First tool	0.862 “good reliability”
Second tool	0.851 “good reliability”

Ethical Considerations

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The research approval was obtained from the ethical committee of the faculty of nursing Helwan University. The researcher was clarified the objectives and aim of the study to hospitalized females included in the study before starting. Written consent was obtained from the hospitalized female before inclusion in the study; a clear and simple explanation was given according to their level of understanding. The hospitalized female secured that all the gathered data was confidential and used for research purpose only. The researcher was assuring maintaining anonymity and confidentiality of subjects' data included in the study. The hospitalized females were informed that allowed to choose to participate or not in the study and have the right to withdrawal from the study at any time.

Pilot Study

The pilot study was carried out on 10% those represent (9) of hospitalized females in order to test the applicability of the constructed tools and the clarity of the questions. The pilot has also served to estimate the time needed for each subject to fill in the questionnaire. According to the results of the pilot, no corrections and omissions of items were performed, so the hospitalized females were included in the study sample.

Fieldwork

- The researcher was visit the study setting every two days per week at morning time 9.00am to 2 pm.
- The data collected within 3 months starting from the beginning of 1January to the end of march 2022,when I were on the head of my work in isolated hospital.
- In the selected study settings, the researcher was be select female, according to pre-mentioned inclusion and exclusion criteria.
- The researcher after introduce herself to the hospitalized female will provide briefly explanation about the nature and purpose of the study
- The hospitalized Female was informed that the data collected during the study was confidential and will be used for research purposes.
- written consent was achieved after explaining the purpose and procedures of the study.
- Each hospitalized female was interviewed individually at the isolation room.
- Follow up of the female was done to assess the effect of covid 19 on the femal reproductive cycle
- On discharge the researcher ask the female their phone number for follow up to fulfill the health assessment questions in follow up phase.

Statistical Analysis



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Data collected from the studied sample was revised, coded, and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages, and Mean SD. Chi-square to assess the relations between variables and their characteristics.

Results:

Table (2) Knowledge levels about Covid-19 preventive measures before, during, after its Quarantine, and total Knowledge levels (N=90)

Levels about COVID-19	Knowledge levels					
	Poor		Average		Good	
	N	%	N	%	N	%
Before Quarantine	2	2.2	36	40	52	57.8
During Quarantine	0	0	23	25.6	67	74.4
After Quarantine	9	10	15	16.7	66	73.3
Total Knowledge levels	1	1.1	21	23.3	68	75.6

Table (2) illustrates that almost three quarters of the studied females (74.4%) have good knowledge about COVID-19 during Quarantine, two fifth of them (40%) have average knowledge about COVID-19 before Quarantine and one tenth of them (10%) have poor knowledge about COVID-19 after Quarantine. In addition, slightly more than three quarters of them (75.6%) have good total knowledge.

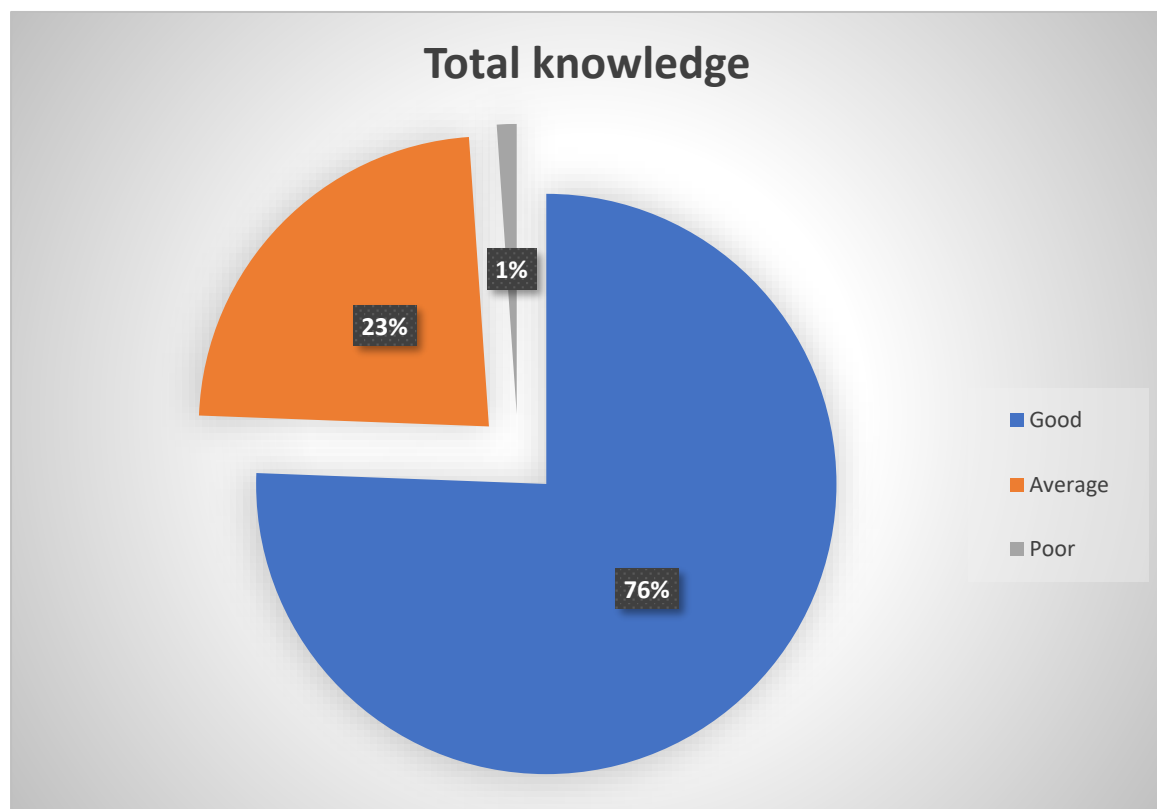


Fig (1) Total knowledge levels among studied females(N=90)

Figure (1) represents that, slightly more than three quarters of the studied females (75.6%) have good level of total knowledge, nearly one quarter of them (23.3%) have average level of knowledge, while the minority of them (1.1%) have poor knowledge.

Table (6) Compare the studied females' according to their Pattern of female reproductive cycle before, during, and after COVID-19 infection (N = 90).

	Before		During		After		Test p. value
	N	%	N	%	N	%	
Amount of the menstrual cycle							
Little	14	15.5	36	40	35	38.9	4.978 0.012*
Moderate	70	77.8	26	28.9	15	16.7	
Large	6	6.7	28	31.1	40	44.4	
Sanitary pads are used							
2-4 pads	26	28.9	46	51.1	42	46.7	4.227 0.018*
5-7 pads	54	60	27	30	29	32.2	
≥ 8 pads	10	11.1	17	18.9	19	21.1	
Experience severe pain							
Yes	21	23.3	81	90	43	47.8	5.600 0.008**
No	69	76.7	9	10	47	52.2	
Contents of menstrual cycle							
Red blood	33	36.7	6	6.7	15	16.7	3.890 0.021*
Dark blood	13	14.4	11	12.2	24	26.7	
Endometritis tissue	44	48.9	30	33.3	33	36.7	
Blood clotting	0	0	43	47.8	18	20	

Table (6) indicates there was slight significant difference between studied females according to amount of menstrual cycle, sanitary pads used, and content of menstrual cycle at before, during, and after COVID-19 infection with p value <0.05*. While, there was high significant difference between studied females according to exercise severe pain at before, during, and after COVID-19 infection with p value <0.01**.

Table (7) Pattern of female reproductive system before, and during COVID-19 infection Quarantine, as well as groups of grand total female reproductive cycle pattern (N=90)

	Groups of FRC pattern			
	Poor pattern		Good pattern	
	N	%	N	%
During Quarantine	56	62.2	34	37.8
Before Quarantine	12	13.3	78	86.7
After Quarantine	14	15.6	76	84.4
Total	5	5.6	85	94.4

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 Table (7) indicates that most of the studied females (86.7%, 84.4%) have good pattern of reproductive system before and after Quarantine, respectively. While nearly two thirds of them (62.2%) have poor pattern during Quarantine. In addition, most of them (94.4%) have good total pattern

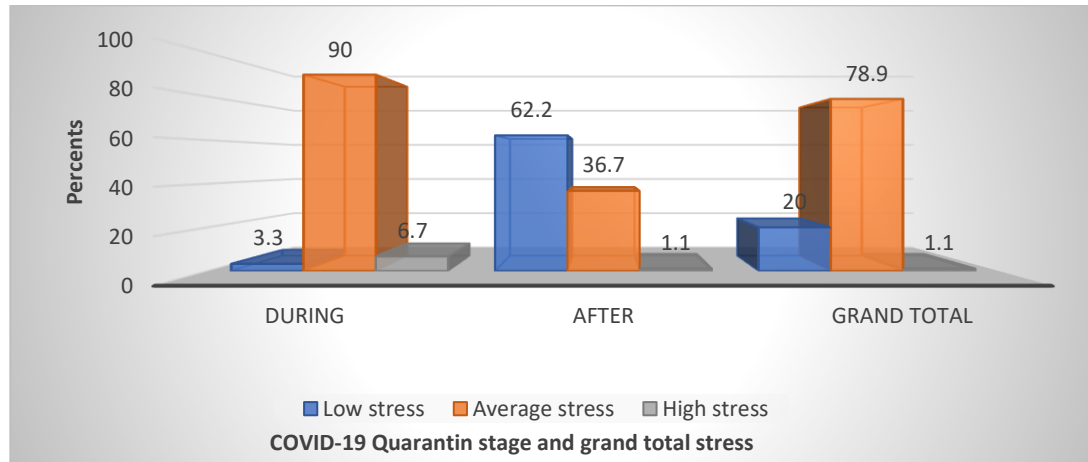


Fig (2) Levels of stress during, after Covid -19 Quarantine, and grand total stress levels among studied females (N=90)

Figure (2) represents that, most of the studied females (90%) have average stress during Quarantine, nearly two thirds of them (62.2%) low stress after Quarantine, and more than three quarters of them (78.9%) have average total stress levels.

Table (8) Correlation between knowledge, female reproductive pattern, stress levels among studied females(N=90)

	Total knowledge
Total stress level	r. - 0.463 p. value <0.01**
Total female reproductive pattern	r. 0.128 p. value >0.05

significant <0.05, ** high significant <0.01**

Table (8) presents that there is no significant correlation between total knowledge and total female reproductive pattern among the studied females ($P>0.05$), while there is highly significant negative correlation between knowledge and stress levels among the studied females ($P<0.01$)

Discussion

COVID-19 has resulted in significant disturbance of daily life for individuals worldwide, with changes to work, social, diet, exercise patterns which has resulted in increased stress (Ashby, 2020). For females there is a greater risk of menstrual dysfunction, this combined with the heightened stress of COVID-19, could result in nationwide spread of aggravated menstrual cycles symptoms and/or increased susceptibility to changes in cycle length. Given the importance of the menstrual cycle for females, the aim of this study was to investigate the effect of COVID-19 pandemic on female reproductive cycle (Bruinvels et al., 2021).

Regarding personal characteristics of the studied hospitalized females, the current study revealed that, most of them ranged in age between 25 to 35 years old with mean 27.9 ± 4.2 years. This result was supported by Demir et al., (2021) who conducted a study in Turkey entitled "Triangle of COVID, anxiety and menstrual cycle" and found that the average age of the participants was 26.3 ± 6.9 years. In contrast, Li et al., (2021) who carried out a study in China about "Analysis of sex hormones and menstruation in COVID-19 women of child-bearing age" and reported that the average age of the studied females was 36 years old. This discrepancy may be related to difference between the study samples.

As well, the present study results showed that more than half of the studied hospitalized females were highly educated. These results were in accordance with de Leon et al., (2022) who conducted a study in Canada about "Higher Perceived Stress during the COVID-19 pandemic increased Menstrual Dysregulation and Menopause Symptoms" and mentioned that most of the studied women were highly educated. Also, the study result agreed with a study in USA carried out by Edelman et al., (2022), whose study entitled "Association between menstrual cycle length and coronavirus disease 2019 (COVID-19) vaccination" and stated most of the studied women had college education and more.

In addition, the current study demonstrated that most of the studied hospitalized females were employee. These findings were matched with a study conducted by Phelan et al., (2021) in Ireland entitled "The impact of the COVID-19 pandemic on women's reproductive health" and reported that most of the studied women were working. Likewise, a study in USA performed by Ozimek et al., (2022) to assess "Impact of stress on menstrual cyclicity during the coronavirus disease 2019 pandemic" they found that the majority of the studied women were working.

Moreover, the current study results declared that, more than half of the studied hospitalized females were from rural area. This result was congruent with a study in UK conducted by Alvergne et al., (2021), entitled "COVID-19 vaccination and menstrual cycle changes" found that most of the studied females were from rural area.

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Regarding the studied females' knowledge levels about Covid-19 preventive measures before, during, after its Quarantine, and total knowledge levels, the present study indicated that almost three quarters of the them had good knowledge about COVID-19 during and after Quarantine respectively, while more than half of them had good knowledge before Quarantine. In addition, slightly more than three quarters of them had good total knowledge, followed by nearly one quarter of them had average knowledge.

Similarly, a study carried out by **Aldhahri & Alghamdi, (2019)**, entitled "Awareness of COVID-19 before and after quarantine based on crowd sourced data from Rabigh City, Saudi Arabia" and found that before quarantine, the participants' knowledge of COVID-19 was not very high. However, after quarantine, most of the studied respondents' knowledge about COVID-19 had increased. This may be related to successful efforts of the Ministry of Health in raising public awareness regarding COVID-19 and preventive measures to control the spread of COVID-19.

In the same line with **Adesegun et al., (2020)** who carried out a study entitled "The COVID-19 crisis in sub-Saharan Africa: knowledge, attitudes, and practices of the Nigerian public" and found that most of the studied subjects exhibited good total knowledge of COVID-19 preventive measures. Likewise, **Yoseph et al., (2021)** who conducted a study about "Knowledge, attitudes, and practices related to COVID-19 pandemic among adult population in Sidama Regional State, Southern Ethiopia", and noticed that the majority of the studied participants had good total knowledge about COVID-19 preventive measures. This may be related to the significant effect of social media and mass media in raising awareness regarding COVID-19 and preventive measures.

Regarding the studied females' pattern of female reproductive cycle before COVID-19 infection, the present study demonstrated that most of them had moderate amount of the menstrual cycle before infection. Also, more than one half of them used 5-7 pads during the menstrual cycle per day. Nearly one quarter of them experienced severe pain during period. In addition, more than one third of them had red blood contents.

Correspondingly, a study conducted by **Bruinvels et al., (2022)** reported that most of the studied females had average menstrual cycle and over a third experienced no changes in bleeding patterns before infection.

Also, **Buran & Gerçek, (2022)** who carried out a study in Turkey to assess "Impact of the awareness and fear of COVID-19 on menstrual symptoms in women" and noticed that most of the women reported that there was no change in the menstrual pattern and content, and less than one quarter of them had severe pain before the pandemic process.

In addition, the present study showed that less than one tenth of the studied females had abnormal secretions. As well, all of them had regular menstrual cycle.

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Moreover, the minority of them had problems with the menstrual cycle. Additionally, more than three quarters of them their menstrual cycle is 2-5 days. Furthermore, almost three quarters of them suffered from malnourished before COVID-19 infection.

In the same field, a study conducted by **Haile et al., (2022)** entitled "The global pandemic and changes in women's reproductive health" and stated that most of the study participants reported that they hadn't changes in their menstrual cycle, the majority of them had regular menstrual cycle and the average days of menstruation was between 2 to 5 days before the pandemic. Similarly, **Phelan et al., (2021)** mentioned that the minority of the studied women had diseases affecting the menstrual cycle and more than half of them were malnourished before COVID-19.

Concerning the studied females' pattern of reproductive system during COVID-19 infection, the current study declared that two fifth of them had little amount of the menstrual cycle during infection. As well, more than half of them used 2-4 pads during the menstrual cycle per day. Most of them experienced changes in menstrual cycle. Also, more than three quarters of them experienced severe pain associated with period. In addition, nearly half of them had blood clotting contents.

This can be interpreted by the fact that menstrual cycle is easily influenced by rising stress levels; COVID-19 pandemic can be a stress inducer due to the fear from lockdowns, from the new disease and the limited data about the efficacy of the preventive measures as vaccines, and the associated long-term complications.

These findings were congruent with **Akinci et al., (2022)** who conducted a study in Turkey entitled "Post-COVID-19 menstrual symptom disorders relating to anxiety and long COVID-19 symptoms" and mentioned that most of the studied participants experienced changes in menstrual cycle and content, and menstrual pain levels showed significant increase compared to pre-COVID-19. Conversely, **Issa et al., (2022)** who carried out a study about "Menstrual symptoms variation among Lebanese women before and after the COVID-19 pandemic" and found that number of days of menses, volume, and number of pads per day scores were higher during COVID-19 pandemic.

Moreover, the present study represented that, more than two fifth of the studied females had severe headache. Most of females had nurse who helps females take care of personal hygiene during isolation. In addition, about two thirds of them had healthy and complete food provided during the period of menstruation and isolation. Moreover, less than one quarter of them had treatment that affects the menstrual cycle and most of them experienced severe pain during menstrual cycle, during COVID-19 infection.

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These results were compatible with **Malloy & Bradley, (2021)**, they carried out a study in Boston entitled "The relationship between perceived stress during the COVID-19 pandemic and menstrual cycles and symptoms" and mentioned that being infected by the COVID-19 was associated with an increase in menstrual symptoms. In the same line, **Akinci et al., (2022)** who stated that the largest proportion of females had someone who helps them had healthy food during isolation.

As regard the studied females' pattern of reproductive cycle after COVID-19 infection, the current study indicated that more than two fifth of them had large amount of the menstrual cycle post infection. Additionally, less than half of them used 2-4 pads during the menstrual cycle per day. More than one quarter of them noticed changes in menstrual cycle after infection. Also, nearly half of them had severe pain associated with period. In addition, more than one third of them had dark blood & membranes contents.

This can be explained by the fact that the infection with COVID-19 could affect the hypothalamic-pituitary-ovarian endometrial axis with resulting changes to the menstrual cycle. Furthermore, COVID-19 has also been associated with endothelial cell dysfunction and alterations in the coagulation system, both critical components of endometrial function at menstruation, indicating a potential endometrial mechanism for menstrual disturbance.

Consistently, **Chourasia et al., (2022)** who conducted a study entitled "Determining the Effect of COVID-19 on the Menstrual Cycle Among Women of Reproductive Age Group in the Jazan Region" and reported that the menstrual cycles changed after COVID-19, in terms of the amount, content of blood, or menses length and increased pain severity level. Similarly, a study conducted by **Anto-Ocrah et al., (2023)**, about "Coronavirus Disease 2019 (COVID-19)–Related Stress and Menstrual Changes" and they reported that less than half of the studied females noticed changes in menstrual cycle after infection.

As well, the current study reflected that two fifth of the studied females had severe headache. Less than one fifth of them had someone who helps them take care of personal hygiene during isolation. In addition, most of them had healthy and complete food provided during the period of menstruation and isolation. Moreover, almost one third of them had treatment that affects the menstrual cycle. Furthermore, nearly half of them experienced severe pain during menstrual cycle after COVID-19 infection.

This may be related to recovery from infection and decreased stress level that has impact the females' menstrual cycle. This finding was in harmony with a study in USA conducted by **Payne et al., (2022)**, entitled "COVID-Related Distress Is Associated with Increased Menstrual Pain and Symptoms in Adult Women" and they

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reported that menstrual pain and severity of symptoms decreased after COVID-19 infection.

According to pattern of female reproductive system before, and during COVID-19 infection Quarantine, as well as groups of grand total female reproductive cycle pattern, the present study revealed that most of the studied females had good pattern of reproductive system before and after Quarantine, respectively. While nearly two thirds of them had poor pattern during Quarantine. In addition, most of them had good total pattern. This can be explained by the fact that the infection with COVID-19 could affect the hypothalamic-pituitary-ovarian endometrial axis with resulting changes to the menstrual cycle.

This result supported by **Issa et al., (2022)** who found that most of the studied females had good pattern of menstrual cycle before COVID-19 infection. Consistently, **Buran & Gerçek, (2022)** who reported that nearly two thirds of the studied women had poor pattern during the pandemic process.

Concerning of the studied females' psychological state after 3 months of COVID-19 isolation, the current study portrayed that more than two fifth of them felt confidence in healing after recovery. Additionally, less than one fifth of them were afraid of getting infected again and affected by the treatment of the health team, respectively. Most of them were satisfied with what the health team provided during the isolation. Besides, less than one fifth of them felt lonely after getting out of isolation. This may be related to increased level of knowledge and psychological support provided by health team and family that improved the level of stress after 3 months of COVID-19 isolation compared to during isolation.

These results were compatible with a study in India conducted by **Tripathy & Mohapatra, (2022)** entitled "The potential impact of COVID-19 on women's reproductive and mental health" and reported that the studied women had low stress level after COVID-19 recovery compared to during COVID-19. In the same line, a study in Turkey conducted by **Akıncı et al., (2022)** and mentioned that most of the studied females had been satisfied with care provided by medical staff during the isolation.

As regard levels of stress during and after COVID -19 Quarantine and grand total stress levels among the studied females, the present study indicated that most of them had average stress during Quarantine, nearly two thirds of them had low stress after Quarantine, and more than three quarters of them had average total stress levels.

This result matched with **Takmaz et al., (2021)** who stated that most of the studied women had average total stress related COVID -19. Also, **Muharam et al., (2022)** who stated that had low stress after isolation.

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As regard correlation between knowledge, female reproductive pattern, stress levels among studied females, the present study portrayed that there was no significant correlation between total knowledge and total female reproductive pattern among the studied females, while there was highly significant negative correlation between knowledge and stress levels among the studied females. This can be explained as females with high level of knowledge regarding COVID – 19 and preventive measures experienced low stress levels, while level of females' knowledge hasn't a direct impact on their menstrual cycle pattern.

Similarly, **Akinci et al., (2022)** who found that there was significant negative correlation between the studied women's level of stress and their level of knowledge regarding COVID – 19. In the same line, **Tripathy & Mohapatra, (2022)** who noticed that there was a negative correlation between knowledge and mental health of the studied women. In contrast, **Lablanche et al., (2022)** who reported that there was negative correlation between the studied women level of knowledge about COVID – 19 and their menstrual cycle.

Conclusion:

In light of the current study, it can be concluded that, slightly more than three quarters of the studied females had good level of total knowledge about Covid-19 preventive measures; nearly one quarter of them had average level of knowledge, while the minority of them had poor knowledge. As well, most of the studied females had good pattern of reproductive system before and after Quarantine. While nearly two thirds of them had poor pattern during Quarantine, while most of them had good total pattern. In addition, most of the studied females had average stress during Quarantine, nearly two thirds of them had low stress after Quarantine, and more than three quarters of them had average total stress levels.

Recommendations:

Based on the findings of the study results, the following recommendations were advocated:

1. Raising women awareness regarding the effect of covid19 infection on their reproductive cycle.
2. Replicate the study to larger sample and in different health settings to generalize the findings.
3. Developing educational programs for women to enhance their knowledge about coping mechanism with stress regarding menstrual disorder during covid 19.

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