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The Relationship Between COVID-19 Vaccines and Menstrual Cycle Characteristics among Nursing Students

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ABSTRACT

Background: since the emergence of COVID-19 vaccinations, many women around the world have reporting abnormalities in menstrual periods post-vaccination. **Aim**: to determine the relationship between COVID-19 vaccines and menstrual characteristics among nursing students **Design**: Descriptive design was used. **Setting**: this study was conducted at the Facu Nursing Helwan University **Sample**: A Purposivesample of 150 female nursing students in the first and second academic 2022-2023 **Tools**: Two tools used to collect data .**Tool (1):** A Structured interviewing questionnaire included demogr characteristics, medical history, COVID-19 vaccines of the subjects, menstrual characteristics of the subjects .**Tool (2):**Men characteristics post COVID-19 vaccine **Results**: The majority of the female students had no change in the number of between two consecutive periods, about one third had change in the length of their menses and menstrual flow, more tha third experienced no change in amount of blood, the majority of them had no amenorrhea or spots between menses vaccination. However, minority of female students experienced dysmenorrhea, with half restoring to pain-relief medi **Conclusion**: COVID-19 vaccines had minimal effect on menstrual characteristics among female nursing students , both of ag the type of COVID-19 vaccine received appeared to be associated with variations in menstrual cycle characteristics, menarche was significantly associated with greater post vaccination menstrual alterations **Recommendations**: Developme educational programs targeting female nursing students to provide accurate information about the potential effect of COV vaccination on menstrual cycles.

Keywords:Menstrual cycle, COVID-19 Vaccinations, Relationship

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Introduction

The menstrual cycle is an important vital sign sensitive to changes in overall health status, with alterations potentially indicating disturbances in the hypothalamic-pituitary-ovarian axis (Akman et al., 2021). The COVID-19 pandemic has created an unprecedented global public health crisis since its onset in early 2020. By August 2023, over 595 million cases and over 6 million deaths have been reported worldwide (Jen et al., 2023). In response, the the development of safe and effective vaccines was urgently needed to reduce morbidity and mortality from the SARS-CoV-2 virus.

While the vaccines have demonstrated efficacy and safety in clinical trials, concerns have emerged regarding potential impacts on various aspects of health. One area of particular interest is the effect of COVID-19 vaccines on the female menstrual cycle. user-submitted smartphone application data beginning in early 2021 first documented increases in cycle length and bleeding duration after COVID-19 vaccination (Male., 2021).

Additional reports described changes including heavier flow, breakthrough bleeding, missed periods, and worsening menstrual pain and premenstrual symptoms (Amer et al., 2022). Understanding the impacts on menstrual health remains a high priority given the scale of global COVID-19 vaccination. Menstrual disturbances, even if temporary, can be distressing and negatively impact well-being and quality of life (Munro et al., 2023). For undergraduate nursing students, who are overwhelmingly female, potential menstrual cycle impacts of COVID-19 vaccination have elevated relevance. Nursing students have been prioritized early in vaccination campaigns due to increased occupational exposure risk and the crucial need to train the frontline healthcare workforce (Rabi et al., 2021).

Nurses should give counseling for early detection and management of various menstrual disorders can improve the quality of life of the complaining women, mitigate their symptoms, and minimize the debilitating health problems. nurses can be menstrual health advocates in women-care settings by discussing the benefits of tracking menstrual health variables in terms of self-awareness and health management along with educating women about menstrual health using inclusive, compassionate language , education and awareness must be improved surrounding menstrual experiences as a potential expected side effect of vaccination (Elzeblawy et al., 2019).

Significance of the study:

By mid-2021, three billion doses of covid vaccines had been administered around the world The Medicines and Healthcare products Regulatory Agency (MHRA)reported 41,919 cases of menstrual problems, including heavier than usual periods, delayed periods, and unexpected vaginal bleeding, Early observational surveys have reported high prevalence of menstrual irregularities post-vaccination, ranging from 15% to over 50% in various study samples (Edelman et al., 2022, Alvergne et al., 2021).

In Jordan about 66.3% of participants reported menstrual symptoms post-vaccination, of which 46.7% experienced them after their first dose. However, in 93.6% of participants, the symptoms resolved within 2 months (Muhaidat et al.,2022)

In Riyadh city Overall, 50.9% of theparticipants reported a menstrual change after vaccination those who received the 2 doses (Morsi et al., 2022). In Egypt: The study conducted at Zagazig University noticed that the (83.5%) vaccinated females reported (38.5%) menstrual changes after being vaccinated, and these menstrual changes resolved in women (55.1%) after more than 9 months (Amer et al., 2022).

Aim of the study:

The aim of this study was to determine the relationship between COVID-19 vaccines and menstrual cycle characteristics among nursing students.

Research question

1-What is the relation between COVID-19 Vaccine and characteristics of Menstrual Cycle?

Subjects and Methods:

Research design:

A descriptive design was used in the current study.

Setting:

The study was conducted at faculty of Nursing Helwan University.

Sample

Type of sample: Purposivesample was utilized in the current study.

Sample size: All female students in the first and second academic year2022-2023 that match the inclusion criteria, agreed to participate in the study. Total number are about 150 female students.

Tools of data collection:

Two tools were used in the current study.

Tool I:A structured interviewing questionnaire :

This tool was designed by researcher, after reviewing the related current and previous literature (Muhaidat et al., 2022) and translated to Arabic language and includes four parts as following:

Part I: Demographic characteristics of the subjects (age, height, weight, body mass index, academic year level, and residence).

Part II: Medical history characteristics of the subjects (chronic disease, previous history of bleeding, Thrombocytopenia, use of blood thinners medication, diagnosed with amenorrhea, fibroids, thyroid disorders, and Polycystic ovary syndrome).

Part III: COVID-19 vaccines of the subjects (types, doses, , wither infected with COVID-19 or not, and date of last dose).Part IV: Menstrual characteristics of the subjects (age at menarche, duration, menstrual flow, dysmenorrhea, length of the menstruation, medication to relieve pain).

Tool II: Menstrual characteristics post COVID-19 vaccine sheet:

It is a standardized designed formulated tool developed by(Muhaidat et al., 2022) and adapted by the researcher. This tool was developed for the specific purpose of assessing menstrual characteristics post COVID-19 vaccination (e.g., change in number of days between two periods, length, amount of blood loss, timing of the first menses after vaccines, dysmenorrhea, amenorrhea, spots between two menses).

Scoring system:

Score ranges for items 1-8 of menstrual characteristics post COVID-19 vaccine sheet as the following : the score has two points (no change score = 2, change score = 1). The composite score was determined by summed up (16) and classified into percent score as the following :

>75% considered no change in menstrual cycle post COVID-19 vaccine.

≤ 75% considered change in menstrual cycle post COVID-19 vaccine.

Reliability:

Testing reliability of proposed tools was done by Cronbach's alpha test through SPSS computer package. "Structured interviewing questionnaire sheet" It was 0.85 , and 0.76 for tool " Menstrual characteristics post COVID-19 vaccine sheet". Which indicate that the two tools were reliable to detect the objectives of the study.

Validity :

Content validity refers to the extent to which the research instruments adequately measure the constructs or variables they are intended to assess. By involving experts in the field, such as professors of obstetrics and gynecological nursing, the research team can benefit from their expertise and insights to refine and improve the tools. Revision of the tools for clarity, relevance, comprehensiveness, understanding, and applicability was done by a panel of expertise composed of three professors of obstetrics and gynecological nursing to measure the content validity of the tools Based on the panel's feedback, modifications were likely made to arrange the questions or adjust the wording or format of the tools.

Ethical consideration:
Prior study conduction, approval was obtained from the Scientific Research Ethics Committee, faculty of nursing, Helwan university. Official permissions to conduct the study were secured. All participants gave their verbal consent to participate in the study sample. The researcher clarified the aim of the study to the students who included on the study. They were assured that anonymity and confidentiality would be guaranteed and informed about their right to refuse or withdraw from the study at any time.

Preparatory phase:
It's important to obtain official permissions and approvals before conducting the study . In this study , the approval obtained from the scientific research and ethics committee of the Faculty of Nursing, Helwan University, as well as the dean of the Faculty of Nursing at the same university. This demonstrates adherence to ethical standards and ensures the protection of participants' rights and well-being It was included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, and internet's periodicals and magazines to develop tools for data collection.

Pilot study:
A pilot study was conducted on 10 students (10% of total sample) to test the clarity, applicability, feasibility & relevance of the tools used and to determine the needed time for the application of the study tools. The female students who were included in the pilot study were included to the sample because no modification was done after conducting pilot study.

Field work:
After official permission obtained from previously mentioned settings. Data collection took place over a period of February 2023, until beginning of March 2023. . To collect the data, the researcher attended at the classroom from 10.00 a.m. to 11.00 a.m., 2 days / week (Mondays, and Wednesday)., until the desired sample size was achieved.
The researcher took their approval to participate in the study prior to data collection and verbal consent was obtained from each participant.
A reviewing of past and current literature covering the various aspects of the problem was done using books, articles, magazines, and network about studies related to --
Assessment was done by the researcher through interviewing every student individually by introducing himself and explain the aim of the study. Then the questionnaire required to fill was given to female students. Students filled the questionnaire in the morning, it took about 20 minutes for each student to complete the questionnaire . The researcher reassure that the joining is voluntary, and the participant has the right to join or withdraw at any time, beside that all information is confidential, and the name is anonymous. Data collected were done through interviewing with participant at classroom.

Statistical analysis:
The collected data were organized, categorized, tabulated, and statistically analyzed using the statistical package for social science (SPSS) version (22) to determine the relationship between COVID-19 Vaccines and Menstrual Cycle Characteristics among Nursing Students. Data were presented in tables and graphs. The statistical analysis included percentage (%), the arithmetic mean ($\overline{X}$), standard deviation (SD), and chi-square (X2).Frequency and percentage for qualitative data: as educational level, residence, BMI. Test of association: Chi-square test was used.

Results :
Table (1) shows that, more than one quarter of the studied sample (37.3%) aged 19 years with a mean age of 18.51 ± 0.9. and more than half of them (58%) are living in an urban area. Also, this table shows that (85.3%) of the studied students are in the first grade. As well (92.7%) their height is between 150-165 cm and (88%) their weight is between 50-65 kg while, most of the studied sample (86.7%) have normal body mass index with a mean of 2.04 ± 0.50.
Table (2): shows that, most of the studied sample (94.7%) don't have chronic disease, and the majority of them (85.3%) don't have previous history of any disease mentioned. Also, the most of them (92%) are not diagnosed with any of the diseases mentioned.
Figure (1): illustrate that (37.5%) of the studied sample who have chronic disease suffer from diabetes mellitus, and the same percentage suffer from obesity, while (25%) suffer from asthma.
Table (3): shows that, about two thirds of the studied sample (61.3%) received a Pfizer vaccination, and (65.3%) received two doses of vaccination. and more than half of them (58.7%) have never had covid-19. Also, this table shows that most of them (93.3%) received their last dose of vaccination more than three months ago.
Figure (2): illustrate that (3.2%) of the infected students don't have symptoms, (71%) of them have mild symptoms, while (16.1%) of them had moderate symptoms, and (9.7%) of them had severe symptoms, but no one are admitted to critical care unit.
Table (4) : shows that, about two thirds of the studied students (62.7%) had their period at the age less than 15years. Near to two-thirds of them have a menstrual cycle every 21-28 days. Most of them (88%) have moderate menstrual flow, and most of them (81.3%) don't have dysmenorrhea. Also, more than one third (42.7%) have a five-day menstrual cycle. As well more than half of them (50.7%) don't take pain relieving medications.
Figure (3): illustrate that (69.3%) of the studied students don't have any change in the period after vaccination ,while (30.7%) of them had menstrual abnormalities.
Table (5):shows that, the majority of the studied students (81.3%) had no change in the number of days between two consecutive periods. About two thirds (63.3%) had no change in the length of their menses. Near to two-thirds of them (72% & 68.7%) had no change in the menstrual flow nor change in the timing of the first period after vaccination and about half of them (45.3%) haven't new dysmenorrhea. Also, majority of them (86.7%) had no amenorrhea nor spots between menses after vaccination.
Table (6): shows the relation between menstrual characteristics total score post vaccination and

demographic characteristics of studied students, it reveals that there is a high statistically significant relation between total menstrual characteristics and both of age, residence, and academic year (p- value < 0.01). while there is a significant relation between total menstrual characteristics and body mass index as (p- value < 0.05).

Table (7): shows the relation between menstrual characteristics total score post vaccination and COVID-19 vaccine characteristics of the studied students, it reveals that there is a high statistically significant relation between total menstrual characteristics and both of previous infection with COVID-19 and severity of its symptoms as (p- value < 0.01). while there is a significant relation between total menstrual characteristics and both of type of vaccines and date of last dose as (p- value < 0.05). But there is no statistically significant relation between total menstrual characteristics and number of doses taken as (p- value > 0.05).

Table (8): shows the relation between menstrual characteristics total score post vaccination and menstrual characteristics of the studied students, it reveals that there is a high statistically significant relation between total menstrual changes and both of age at menarche and menstrual flow as (p- value < 0.01). while there is a significant relation between total menstrual characteristics and both of dysmenorrhea and duration of menses as (p- value < 0.05). But there is no statistically significant relation between total menstrual characteristics and Taking medications to relieve pain as (p- value > 0.05).

Table 1: Distribution of the studied students' demographic characteristics (N = 150).

Items	No.	%
Age:		
17 years	20	13.3
18 years	54	36.0
19 years	56	37.3
20 years	20	13.3
Mean ± SD	18.51± 0.9	
Height:		
<150 cm	7	4.7
150-165 cm	139	92.7
>165 cm	4	2.6
Weight :		
< 50kg	8	5.3
50-65 kg	132	88
>65 kg	10	6.7
Body Mass Index:		
Underweight	10	6.7
Normal	130	86.7
Overweight	4	2.7
Obese	6	4.0
Mean ± SD	2.04± 0.50	
Academic Year:		
First	128	85.3
Second	22	14.7
Residence :		
Urban	88	58.7
Rural	62	41.3
Total	150	100

Table 2: Distribution of the studied sample's medical history (N = 150).

Items	No.	%
Chronic disease :		
Yes	8	5.3
No	142	94.7
Previous history of :		
Bleeding	6	4
Thrombocytopenia	12	8
Use of blood thinners medication	4	2.7
Nothing	128	85.3
Diagnosed with:		
Amenorrhea	2	1.3
Fibroids	4	2.7
Thyroid disorder	6	4
Nothing	138	92

Figure (1): Percentage distribution of types of chronic disease among the studied students who have (n=8).

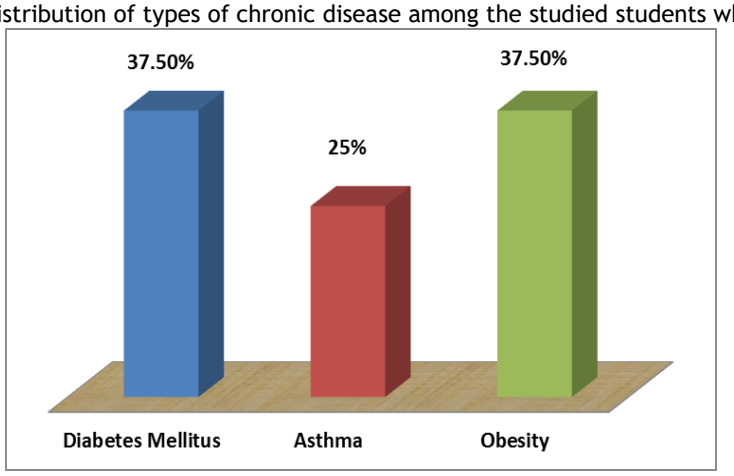

Table 3: Distribution of the studied sample's COVID-19 vaccines characteristics (N = 150).

Items	No.	%
Type of the vaccine:		
Sinopharm	10	6.7
Pfizer	92	61.3
AstraZeneca	44	29.3
Johnson	0	0
More than type	4	2.7
Number of doses:		
Two doses	98	65.3
Three doses	52	34.7
Previous infections with covid-19:		
Yes	26	17.3
Had symptoms, but not diagnosed.	36	24.0
No	88	58.7
Date of last dose.		
< 1month	2	1.3
1-3Months	8	5.3
>3 months	140	93.3

Figure (2): Percentage distribution of severity of COVID-19 symptoms among infected studied sample (n-62).

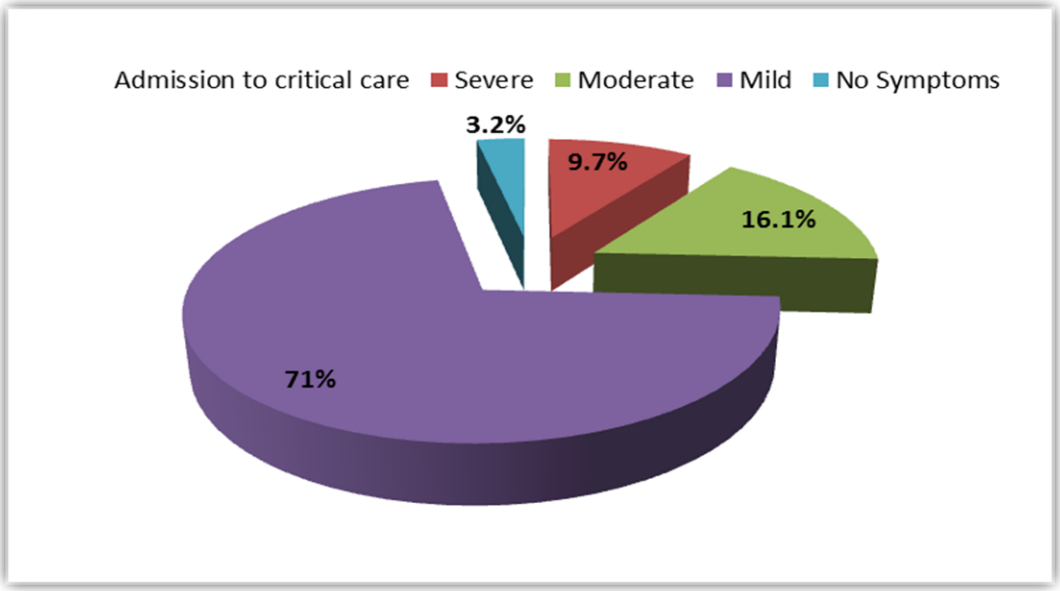

Table 4: Distribution of menstrual characteristics of the studied students(N =150).

Items	No.	%
Age at menarche:		
< 15 years	94	62.7
≥ 15 years	56	37.3
Duration of the menstrual cycle:		
< 21 days	20	13.3
21-28 days	112	74.7
29-35 days	18	12.0
Menstrual flow:		
Heavy	10	6.7
Moderate	132	88.0
Light	8	5.3
Dysmenorrhea :		
Yes	28	18.7
No	122	81.3
Length of the menstruation:		
Three days	12	8.0
Four days	32	21.3
Five days	64	42.7
>5 days	42	28.0
Taking medications to relieve pain:		
Yes	76	50.7
No	74	49.3

Table 5: Distribution of menstrual characteristics after receiving COVID-19 vaccines (N =150).

Items	No.	%
Change in number of days between two periods.		
No change	122	81.3
Become shorter.	6	4.0
Become longer	22	14.7
Change in the length of menses.		
No change	95	63.3
Increase	33	22.0
Decrease	22	14.7
Change in the amount of blood loss.		
No change	108	72
Increase	22	14.7
Decrease	20	13.3
Timing of the 1st period after vaccination		
Early	23	15.3
Late	24	16.0
No change	103	68.7
New dysmenorrhea		
Yes	34	22.7
No	68	45.3
Not sure	48	32.0
Amenorrhea		
Yes	20	13.3
No	130	86.7
Spots between two menses		
Yes	20	13.3
No	130	86.7

Figure (3): Distribution of menstrual changes total score after COVID-19 vaccination among studied sample (n=150).

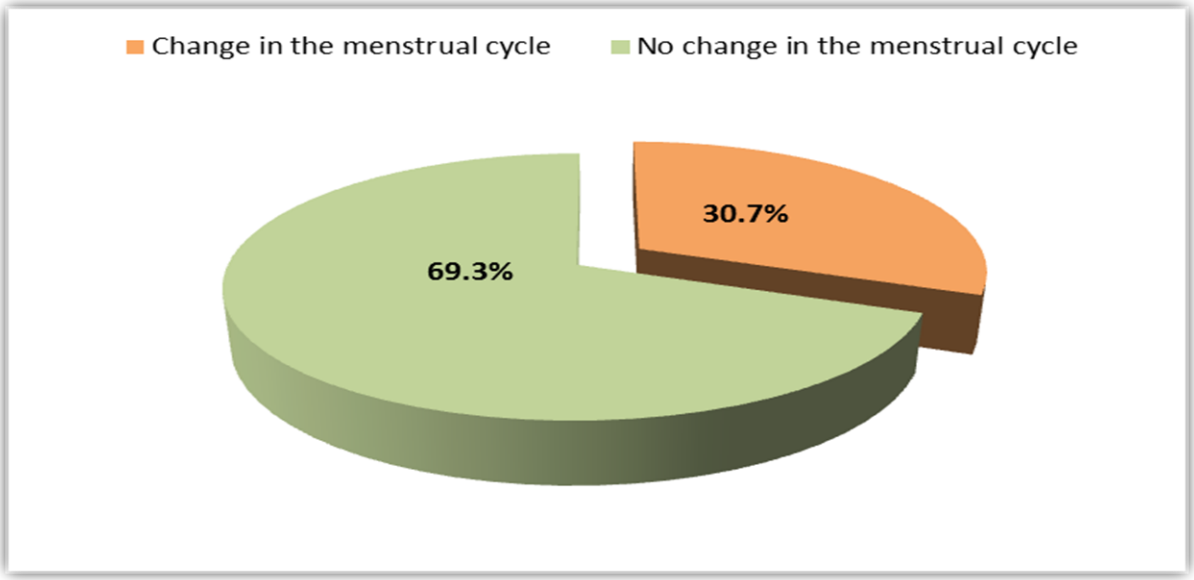

Table (6): Relation between total score of menstrual characteristics post vaccination and demographic characteristics of the studied students.

Items		Menstrual characteristics				Chi-square		
		No changes in the menses		Changes in the menses		X2	p- value	Sig.
		No	%	No	%			
Age	17 years	20	13.3	0	0	16.96	0.001**	HS
	18 years	37	24.7	17	11.3			
	19 years	39	26	17	11.3			
	20 years	8	5.3	12	8			
Residence	Rural	34	22.7	28	18.7	10.44	0.001**	HS
	Urban	70	46.7	18	12			
Academic year	First	100	66.7	28	18.7	31.73	0.000**	HS
	Second	4	2.7	18	12			
Body mass index	Underweight	10	6.7	0	0	14.07	0.003*	S
	Normal	89	59.3	41	27.3			
	Overweight	4	2.7	0	0			
	Obese	1	0.7	5	3.3			

Table (7): Relation between total score of menstrual changes post vaccination and COVID-19 vaccine characteristics of the studied students.

Items		Menstrual characteristics total score post vaccination				Chi-square		
		No changes in the menses		Changes in the menses				
		No.	%	No.	%	X2	p- value	Sig.
Type of vaccine	Sinopharm	10	6.7	0	0	13.7	0.003*	S
	Pfizer	57	38	35	23.3			
	AstraZeneca	36	24	8	5.3			
	More than one	1	0.7	3	2			
Number of doses	Two doses	67	44.7	31	20.7	0.12	0.85	NS
	Three doses	37	24.7	15	10			
Previous infections with covid-19	Yes	8	5.3	18	12	24.76	0.000**	HS
	Had symptoms but not diagnosed	24	16	12	8			
	No	72	48	16	10.7			
Severity of covid-19 symptoms	No	0	0	2	1.3	47.39	0.000**	HS
	Mild	32	21.3	12	8			
	Moderate	0	0	10	6.7			
	Severe	0	0	6	4			
Date of last dose	< 1month	1	0.7	1	0.7	8.27	0.016*	S
	1-3 months	2	1.3	6	4			
	>3 months	101	67.3	39	26			

HS** = High Significant S* = Significant NS = No Significant

Table (8): The relation between total score of menstrual characteristics post vaccination and menstrual characteristics of the studied students.

Items		Menstrual characteristics total score post vaccination				Chi-square		
		No changes in the menses		Changes in the menses				
		No.	%	No.	%	X2	p- value	Sig.
Age at menarche	< 15years	75	50	19	12.7	12.94	0.000**	HS
	≥ 15years	29	19.3	27	18			
Dysmenorrhea	Yes	14	9.3	14	9.3	6.05	0.02*	S
	No	90	60	32	21.3			
Duration	<21 days	8	5.3	12	8	12.63	0.002*	S
	21-28 days	86	57.3	26	17.3			
	29 – 35 days	10	6.7	8	5.3			
Flow	Heavy	7	4.7	3	2	19.16	0.000**	HS
	Moderate	97	64.7	35	23.3			
	Light	0	0	8	5.3			
Length	3 days	3	2	9	6	12.17	0.007*	S
	4 days	24	16	8	5.3			
	5 days	46	30.7	18	12			
	>5 days	31	20.7	11	7.3			
Taking medications to relieve pain	Yes	56	37.3	20	13.3	1.37	0.29	NS
	No	48	32	26	17.3			

HS** = High Significant S* = Significant NS = No Significant

Discussion:

The results of current study population included 150 female nursing students with an average age of 18.51 years. most students were of average height (150-165 cm) and the majority had normal BMI, the majority in their first year of university, and more than half lived in urban areas. Overall, this was a young, healthy cohort, with most reporting no chronic diseases and the majority had previous bleeding/clotting issues.

Regarding COVID-19 vaccination, about two third common vaccine received was Pfizer, and about two thirds were fully vaccinated with two doses. More than half reported no prior COVID-19 infection, and the most had received their last vaccine dose over 3 months before the study. In terms of menstrual characteristics, most students had regular, moderate, 4-5-day menstrual cycles. However, minority experienced dysmenorrhea and half took medications to relieve menstrual pain. In summary, this predominantly urban, fully vaccinated young student population with regular menses also commonly experienced dysmenorrhea and used medications for pain relief.

A study conducted in Taif by Filfilan et al., 2023 entitled "Effects of Different Types of COVID-19 Vaccines on Menstrual Cycles of Females of Reproductive Age Group' reported the socio-demographic and clinical characteristics of 2,381 women included in the study sample. more than two thirds were Saudi Arabian, the most from an urban background, and the majority between the ages of 15-30 years. the most had their first period between ages 11-15 years, about two thirds completed secondary/high school education and the

majority were single.

Regarding medical conditions, minority reported having any medical problem, with anemia being most common. In terms of COVID-19 vaccination status, more than half received two doses, while more than one third received three doses.

As well as, study in MENA (Middle-East and North Africa) Muhaidat et al., 2022 entitled "Menstrual symptoms after COVID-19 vaccine: a cross-sectional investigation in the MENA region" noticed the study included 2,269 women aged 14-40 years old, with about two thirds from Jordan, minority from united Arab Emirates, and Saudi Arabia. on average, participants were 34.32 years old.

Among the COVID-19 vaccines administered, Pfizer was the most prevalent, accounting for approximately 50% of the administered doses. Sinopharm accounted for over one-third of the vaccines administered, while AstraZeneca was the least commonly administered vaccine. Most individuals received both doses of the vaccine, indicating that they completed the recommended vaccination regimen. Less than 25% of the individuals had confirmed COVID-19 infections, suggesting that a significant portion of the vaccinated population remained protected from the virus. Furthermore, only a minority of individuals reported experiencing symptoms resembling those of COVID-19.

Regarding menstrual history, the majority had regular cycles in the past year, while less than one quarter had irregular cycles. Less than one third were smokers, and minority had a history of coagulation disorders. Less than one quarter had a history of asthma, drug, or food allergies. the majority were disease-free, minority though conditions like PCOS, thyroid disorders, uterine fibroids, and endometriosis were present Muhaidat et al., 2022 entitled" Menstrual symptoms after COVID-19 vaccine: a cross-sectional investigation in the MENA region"

In present study, COVID-19 vaccination had minimal effects on menstrual cycle characteristics among most nursing students in this study. The majority reported no change in the length of time between periods after vaccination. Nearly two-thirds saw no difference in menstrual flow length, and around more than two thirds had no change in amount of menstrual bleeding. Additionally, most students' first period after vaccination was at the expected time, and around half did not experience new dysmenorrhea. The majority did not have post-vaccination amenorrhea or unexpected mid-cycle spotting.

These findings agree with other recent studies showing limited menstrual changes after COVID-19 vaccination in most individuals. A large UK study found no population-level changes in menstrual cycle length after vaccination when analyzing anonymized app data from over 4,000 women Male., 2021entitled "Effect of COVID-19 vaccination on menstrual periods in a retrospectively recruited cohort".

Similarly, a U.S. study by Edelman et al., 2022 entitled "Association between menstrual cycle length and coronavirus disease 2019 (COVID-19) vaccination" reported no increase in menstrual cycle irregularities after mRNA COVID-19 vaccination among a cohort of over 2,400 patients. However, Illinois study found a minority of individuals do appear to experience temporary menstrual changes post-vaccination, including shorter cycle length and heavier flow Lee et al., 2022.entitled" Investigating trends in those who experience menstrual bleeding changes after SARS-CoV-2 vaccination"

In contrast, some studies have suggested more prevalent menstrual changes associated with COVID-19 vaccination. In a United Kingdom. survey study, more than one third unvaccinated respondents noted increased menstrual bleeding after vaccination Trogstad., 2022 entitled" Increased occurrence of menstrual disturbances in 18-to 30-year-old women after COVID-19 vaccination" An England study found that over half of female healthcare workers reported altered cycle length and flow after two vaccine doses Hall et al., 2021 entitled" Effectiveness of BNT162b2 mRNA vaccine against infection and COVID-19 vaccine coverage in healthcare workers in England, multicenter prospective cohort study"

In current study, the results show a highly significant association between age and menstrual changes post-vaccination. The percentage of students reporting changes increased with older age, this suggests menstrual changes may be more common with increasing age.

Current results are consistent with Alghamdi et al., 2021 entitled" BNT162b2 and ChAdOx1 SARS-CoV-2 post-vaccination side-effects among Saudi vaccines" in Saudi Arabia noted alterations in the menstrual cycle of women within the same age group following receipt of the COVID-19 vaccine, contrasting with some previous research inconsistent a study by Edelman et al., 2022 entitled" Association between menstrual cycle length and coronavirus disease 2019 (COVID-19) vaccination: a US cohort" found

no correlation between age and menstrual changes following COVID-19 vaccination.

Regarding Body Mass Index in present study, showed a significant association was found between BMI category and menstrual changes after vaccination. No underweight students reported changes, while the highest percentage was among obese students. Edelman et al., 2022. entitled" Association between menstrual cycle length and coronavirus disease 2019 (COVID-19) vaccination: a US cohort" have similarly reported links between higher BMI and menstrual changes following COVID-19 vaccination. Proposed mechanisms relate to inflammatory processes.

In present result found no statistically significant association between total menstrual changes post-vaccination and having chronic diseases or past medical history like bleeding disorders, thrombocytopenia, or anticoagulant use .This suggests that having these pre-existing conditions did not impact changes in menstrual characteristics after COVID-19 vaccination in this sample of nursing students.

In the current study, students with amenorrhea, fibroids, or thyroid issues may be at higher risk for menstrual changes post-COVID vaccination. go in line with a study conducted in the United States, participants diagnosed with fibroids had a marginally higher likelihood of experiencing heavier bleeding Lee et al., 2021 entitled" Characterizing menstrual bleeding changes occurring after SARS-CoV-2 vaccination". Conversely, in a prior study conducted in the UK, participants with conditions such as polycystic ovary syndrome (PCOS) and endometriosis were somewhat more inclined to report a delay or an earlier onset of the cycle post-vaccination, although the significance was borderline. However, participants who had pre-existing diagnoses of fibroids and heavy menstrual bleeding did not show a higher likelihood of reporting a change in menstrual flow compared to others Male., 2021. entitled" Effect of COVID-19 vaccination on menstrual periods in a retrospectively recruited cohort."

present results indicate a significant association between total menstrual change score post-vaccination and type of COVID-19 vaccine received. Specifically, a higher proportion of students who received the Pfizer vaccine reported menstrual changes compared to those who received Sinopharm or AstraZeneca. A cross-sectional study was carried out in Saudi Arabia, assessing changes in the menstrual cycles of 731 women who were administered the Pfizer-BioNTech COVID-19 vaccine. The research revealed a high prevalence of menstrual irregularities following vaccination Morsi et al., 2022. entitled" The Association Between COVID-19 Pfizer Vaccine and The Reported Post-Vaccination Menstrual Changes Citizen and Resident Women in KSA: Results of Riyadh Survey Study."

Statistically significant differences were seen based on vaccine type and age-viral vector vaccines were more likely to cause menstrual changes compared to mRNA or inactivated virus vaccines, where about half received vaccines with mRNA platform (Pfizer and Moderna), followed by minority of inactivated virus (Sinovac, Sinopharm), vaccines with chimpanzee adenovirus (AstraZeneca) and minority with human adenovirus platform.

This could be due to that, stimulation of receptors in the endometrium by the vaccine antigen. receptors are differentially expressed during the menstrual cycle and activated by SARS-CoV-2 vaccines may stimulate these receptors.

Contrasting to present results in France Alvergne et al., 2023 entitled "A retrospective case-control study on menstrual cycle changes following COVID-19 vaccination and disease" research did not reveal any correlation between the type of vaccine (Pfizer vs. AstraZeneca) or the number of doses administered and changes in menstruation post-vaccination. This finding agrees with reports from the yellow card surveillance scheme and with other studies in USA comparing menstrual changes following the Pfizer and Moderna vaccines Lee et al., 2022 entitled "Investigating trends in those who experience menstrual bleeding changes after SARS-CoV-2 vaccination, or among the Pfizer, AstraZeneca, and Moderna vaccines in London Male., 2021 entitled" Effect of COVID-19 vaccination on menstrual periods in a retrospectively recruited cohort".

In present result found a highly significant relation between total menstrual change score and previous COVID-19 infection. A greater percentage of students with prior confirmed COVID-19 infections reported menstrual changes post-vaccination compared to those without infection. Additionally, severity of prior COVID-19 symptoms showed a highly significant association with total menstrual change. Supported by Muhaidat et al., 2022 entitle" Menstrual symptoms after COVID-19 vaccine: a cross-sectional investigation in the MENA region" reported that there was a significant association between the severity of prior COVID-19 infection and post-vaccination

menstrual abnormalities. Women with more severe COVID-19 infections were more likely to experience menstrual changes after vaccination compared to those with milder or no prior infection.

The study found a higher percentage of menstrual changes among students who were vaccinated within the past 1-3 months compared to those vaccinated over 3 months ago. This suggests that menstrual changes may be most noticeable shortly after vaccination.Additionally, the research conducted in London by male.,2021 found that menstrual symptoms largely resolve within 1-2 menstrual cycles. This suggests that any menstrual changes experienced because of COVID-19 vaccination may be temporary and resolve relatively quickly.It's important to note that this information is based on the specific study ("Menstrual changes after COVID-19 vaccination") and may not be representative of all individuals or populations. Further research and studies are needed to fully understand the relationship between COVID-19 vaccination and menstrual changes.

According to the results of this study, there was a significant relationship between total scores of menstrual cycle changes after COVID-19 vaccination and certain menstrual characteristics among the nursing students studied. Specifically, there was a highly significant association between total menstrual change scores and age at menarche. Students who had early menarche (<15 years) were more likely to report overall changes to their cycles post-vaccination compared to those with menarche at ≥15 years.

However, this is just an observational finding based on self-reports. Additional research would be needed to confirm any causal relationship. Possible mechanisms could be explored - early menarche may coincide with long-term hormonal differences that make an individual more sensitive to hormonal fluctuations related to immune activation from vaccination. But this would require further investigation.

Additionally, among students who reported no dysmenorrhea, more than half had no menstrual changes after vaccination while less than one quarter had changes. In contrast, among students with dysmenorrhea, equal minority percentages were found to have no menstrual changes or to have changes after vaccination. This difference was statistically significant, indicating that students who experienced dysmenorrhea were more likely to report menstrual changes after COVID-19 vaccination compared to students without dysmenorrhea. This findings is in accordance with Trogstad., 2022 entitled "Increased occurrence of menstrual disturbances in 18- to 30-year-old women after COVID-19 vaccination" conducted a cohort study among over 5,500 Norwegian women aged 18-30 years who received COVID-19 vaccines. The researchers found that the prevalence painful periods, minority reported dysmenorrhea after vaccination.

A study conducted in Taif by Filfilan et al., 2023 entitled "Effects of Different Types of COVID-19 Vaccines on Menstrual Cycles of Females of Reproductive Age Group (15-49): A Multinational Cross-Sectional Study" indicate that more than two thirds of the participants experienced alterations in their menstrual cycles after receiving the COVID-19 vaccine. Among these individuals, more than half noted menstrual disturbances after the second injection, less than one quarter after the initial injection, and a minority after the third injection. Even before the advent of the COVID-19 pandemic and initiation of vaccination campaigns, the rate of menstrual irregularities was relatively high globally.

Muhaidat et al., 2022 entitle "Menstrual symptoms after COVID-19 vaccine: a cross-sectional investigation in the MENA region" reported that before receiving their vaccinations during the COVID-19 pandemic, about more than one-third of the individuals in the study noted shifts in their menstrual cycles. However, this figure climbed to more than two thirds following vaccination. There's a pronounced difference between the menstrual changes during the pandemic and the irregularities after vaccination, even after adjusting for menstrual changes during the pandemic. In the same context, at Indonesia Muharam et al., 2022 entitled " Menstrual cycle changes and mental health states of women hospitalized due to COVID-19" found that the number of patients experiencing dysmenorrhea after COVID-19 infection was twice as many as those who had dysmenorrhea before the infection.

A recent preprint study involving 39,129 U.S. participants, where dysmenorrhea after vaccination was reported by more than one third Lee et al., 2021.entitled "Characterizing menstrual bleeding changes occurring after SARS-CoV-2 vaccination". In another study, a retrospective analysis of 4989 premenopausal vaccinated individuals in the U.K., only less than one quarter reported no dysmenorrhea in their menstrual cycle for as long as four months following their initial COVID-19 vaccine dose Alvergne et al., 2021entitle "COVID-19 vaccination and

menstrual cycle changes: A United Kingdom (UK) retrospective case-control study"

The association between dysmenorrhea and COVID-19 vaccination. suggests that the intense immune response and subsequent stress post-COVID-19 vaccination could influence the hypothalamic-pituitary-ovarian axis, leading to dysmenorrhea.

This contrasts to some studies indicating no significant differences in menstrual symptoms between vaccinated and unvaccinated women Male, 2021entitled "Effect of COVID-19 vaccination on menstrual periods in a retrospectively recruited cohort". As well as this Norwegian cohort study examined menstrual changes among 79 women over 18 years old who had regular menstrual cycles or used hormonal contraceptives. The results showed no statistically significant changes in menstrual cycle symptoms following COVID-19 vaccination Woon and Male., 2022 in London entitled "Effect of COVID-19 vaccination on menstrual periods in a prospectively recruited cohort"

In current study, duration of menses shifted to more commonly being shorter (<21 days) or longer (29-35 days) among those reporting menstrual changes after vaccination compared to those without changes. Heavy menstrual flow was less common while light flow more common in those with menstrual changes. Finally, those with menstrual changes more often had shorter or longer menstrual periods of 3 days or >5 days).

The same finding was observed by Muhaidat et al., 2022 entitle "Menstrual symptoms after COVID-19 vaccine: a cross-sectional investigation in the MENA region" the vaccine significantly altered both menstrual duration and menstrual cycle length in the women who were vaccinated, leading to a noticeable difference pre- and post-vaccination. While some participants reported a decrease in both menstrual duration and cycle length and others reported an increase, the average duration saw a significant increase from 6 ± 0.03 days before vaccination to 6.5 ± 0.1 days after vaccination. Similarly, the average menstrual cycle length significantly increased from 27 ± 6 days pre-vaccination to 28.1 ± 10 days post-vaccination.

Comparable results were found in two studies conducted in Saudi Arabia and China to evaluate menstrual cycle length in the women who were vaccinated, Morsi et al., 2022 entitled "The Association Between COVID-19 Pfizer Vaccine and The Reported Post-Vaccination Menstrual Changes Citizen and Resident Women in KSA: Results of Riyadh Survey Study" conducted a cross-sectional study in Saudi Arabia evaluating menstrual cycle changes among 731 women who received the Pfizer-BioNTech COVID-19 vaccine.

The study found high rates of menstrual abnormalities post-vaccination, including menorrhagia more than one third, polymenorrhagia about two thirds ,oligomenorrhea about one third, and dysmenorrhea about two thirds. The authors note that post-vaccination menstrual changes might be related to age, marital status, and receiving two vaccine doses, and could be due to immune responses commonly triggered by vaccines. The other study in China was conducted a large cross-sectional study of 13,118 women aged 18-45 who received COVID-19 vaccination. The study found post-vaccination increases in several menstrual disorders, including minority metrorrhagia , hypomenorrhea, and amenorrhea) Zhang et al., 2022 entitle" COVID-19 vaccine and menstrual conditions in female: data analysis of the Vaccine Adverse Event Reporting System (VAERS)"

A recent meta-analysis in Saudi Arabia aimed to determine the combined prevalence of different menstrual disorders in women after receiving the COVID-19 vaccine. They discovered that around a quarter of women experienced menorrhagia, followed by oligomenorrhea, polymenorrhagia, and irregular menstrual cycle length Al Kadri et al., 2023.entitled "COVID-19 vaccination and menstrual disorders among women: Findings from a meta-analysis study" When comparing the prevalence of these menstrual irregularities with existing literature, a systematic review in Delhi was reported that minority of women experienced oligomenorrhea, polymenorrhagia and about a quarter had an abnormal cycle length Sani et al., 2021.entitled "Systematic Review on Prevalence of Menstrual Disorders Among Women"

Similarly, a meta-analysis conducted in Iran revealed that the burden was minority oligomenorrhea, polymenorrhagia and menorrhagia, respectively. present results agree with a recent systematic review that reported that menstrual disorders such as menorrhagia and polymenorrhagia are common in women following COVID-19 vaccination Nazir et al., 2022.entitled "Menstrual abnormalities after COVID-19 vaccines: a systematic review" This could be due to that, after vaccination lots of chemical signals which have the potential to affect immune cells are circulating round the body. This could cause the womb lining to shed.

Conclusion:

The findings of the study concluded that ,COVID-19 vaccines had minimal effect on menstrual characteristics for most female nursing students . Both of age and the type of COVID-19 vaccine received appeared to be associated with variations in menstrual cycle characteristics, early menarche was significantly associated with greater post vaccination menstrual alterations. Based on these findings, the research questions posed in the study have been answered, providing insights into the potential effects of COVID-19 vaccines on menstrual characteristics among female nursing students. These findings contribute to our understanding of the topic and can help inform healthcare providers and individuals about potential effects of the vaccines on menstrual health.

Recommendation:

Based on this study finding there are some recommendations as follows:

Development of educational programs targeting young individuals, especially female nursing students, to provide accurate information about the potential effect of COVID-19 vaccination on menstrual cycles. this can help manage expectations and reduce unnecessary anxiety.

Development of educational booklet targeting female nursing students to provide awareness of potential effect of COVID-19 vaccines on menstrual cycle.

Further studies:

It is worth noting that research in this area is still evolving, and additional studies are needed to further explore the relationship between COVID-19 vaccines and menstrual alterations.

Development educational program targeting maternity nurses about effect of COVID-19 vaccines on menstrual cycle to provide awareness about potential any abnormalities.

Replication the study on larger and more diverse populations to validate and expand upon these findings. longitudinal studies can provide a better understanding of the long-term effects of COVID-19 vaccination on menstrual cycles.

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