

Menstrual changes associated with COVID-19 vaccine among adolescent females

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Abstract

COVID-19 Vaccines are currently the leading approach for combating the pandemic's advance. Despite, their protective effect has been frequently addressed but little knowledge is available regarding menstrual changes after the covid-19 vaccine. **Aim:** The study aimed to assess menstrual changes associated with COVID-19 vaccine among adolescent females. **Design:** A descriptive comparative cross-sectional study. **Sample:** A convenient sample of 412 adolescent females applied in Beni-Suef City through social media such as Facebook and WhatsApp groups. **Tools:** Data were collected using three online questionnaires including 1) Socio-demographic characteristics 2) Assessment of menstrual characteristics 3) Beck Anxiety Inventory (BAI). **Results:** The current findings indicated there were non-significant statistical differences between both vaccinated and non-vaccinated groups which mean that both groups had similar demographic characteristics. The mean age for vaccinated group was (21.48±2.27) while for non-vaccinated was (21.31±2.38). **Conclusion:** The present study showed that COVID-19 vaccine is associated with a small change in menstrual cycle. The majority of vaccinated group had delay in the date of menstrual cycle, on the other hand, about two thirds of non-vaccinated and about three quarters of vaccinated group had between 9 and 12 spontaneous menstrual cycles per year. **So study recommended:** Further studies are needed to determine an association between the Covid-19 vaccine and menstrual changes.

Keywords: Adolescent female, Covid-19 vaccine & Menstrual cycle.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused a major public health crisis around the world and is expected to continue to impose enormous burdens of morbidity and mortality (Lazarus, et al., 2020). According to an opinion piece written by an international specialist, the likelihood of COVID-19 vaccines causing menstruation alterations in women warrants more investigation. While there is no evidence that COVID-19 vaccines have any negative effects on fertility, the expert claims that there have been over 30,000 reports to a UK vaccine tracking agency of typically transient changes in periods following vaccination. Even though the number of reports is still tiny in comparison to the size of the UK vaccination program, the expert believes that the potential effects of vaccines on periods should be investigated more so that women know what to expect. (Medicines and Healthcare Products Regulatory Agency, 2021)

Menstruation is an important component of the active reproductive life of a woman. The regularity

of menstrual cycles reflects changes in the levels of these hormones, which can have an impact on physical, emotional, and psychological health. Hormonal changes, genetics, major medical issues, body mass index, age, family history, socioeconomic, dietary habits, education, lifestyle, exercises, weight, height, and psychological distress can all alter the regularity and amount of flow of a girl's menstrual cycle. (El Nagar et al., 2017).

Several COVID-19 vaccines have been approved worldwide. According to Bloomberg figures, more than 3.51 billion doses had been provided in 180 countries. The most recent figure was around 30.5 million doses each day. Over 3.51 billion doses have been given out, which is enough to vaccinate 22.9 percent of the world's population. Egypt's immunization rate is relatively low; 4851349 doses were delivered to 2.4 percent of the population (Zewude, et al., 2021).

The majority of persons who experience a change in their menstruation after immunization find that it recovers to normal the next cycle, and there is no evidence that the covid-19 vaccine harms fertility (Morris et al., 2021).

Although documented abnormalities in the menstrual cycle following immunization are transient, thorough research into this probable side effect is crucial to the vaccination program's overall success. Young women's vaccine apprehension stems mostly from incorrect assertions that the covid-19 vaccine may affect their chances of becoming pregnant in the future. (Speed 2021). Failure to fully evaluate claims of menstruation abnormalities following vaccination is likely to exacerbate these concerns. This information will assist people to plan for potentially altered periods if a relationship between vaccination and menstrual alterations is confirmed. For those who rely on being able to forecast their menstrual cycles to obtain or avoid pregnancy, having clear and trustworthy information is very vital. (Royal College of Obstetricians and Gynecologists, 2021).

Through planning, identification of target groups, community engagement and mobilization, service delivery, and tracking and follow-up, health nurses can help promote vaccine uptake among the public. With their understanding of "last mile" health service delivery, experience supporting vaccination uptake, and the ability to create evidence that increases confidence and credibility within the public, CHWs, along with other community-based providers, are crucial interlocutors. Because vaccine uptake is poor, determining the acceptance of COVID-19 immunizations is critical. (WHO, 2021).

Significance of the study:

There is no indication that transient alterations in a person's fertility or ability to produce children will have any effect in the future. Vaccination is the most successful and cost-effective health intervention to protect from the coronavirus. Over 50% of the United States population have received at least one dose of the vaccine, while over 40% are fully vaccinated according to CDC. (CDC, 2021)

According to the UK's Medicines and Healthcare Products Regulatory Agency, a sore arm, fever, weakness, and myalgia are all frequent side effects of the covid-19 vaccine (MHRA). (The Agency for the Regulation of Medicines and Healthcare Products, 2021). Patients who have had these occurrences soon after immunization are increasingly seeking primary care providers and reproductive health professionals, although 41,919 cases changes in menstruation, delayed menstruation and unexpected vaginal bleeding are reported Over 30 000 complaints of these instances had been received by the MHRA's yellow card surveillance scheme for adverse drug reactions (Male, 2021). There is a lack of evidence about published studies

in Egypt about association between the Covid-19 vaccine and menstrual changes. Therefore, the present study aimed to investigate menstrual changes among adolescent females after the Covid-19 vaccine to help us to compare change in the menstrual cycle of those who received a vaccine and who did not receive a vaccine.

Aim

The current study aimed to assess menstrual changes associated with COVID-19 vaccine among adolescent females. **The aim of this study was achieved through the following objective:**

- Assess menstrual changes among vaccinated and non-vaccinated adolescent female.
- Explore the physical and psychological symptoms among vaccinated and non - vaccinated adolescent female.
- Identify a relation between the Covid-19 vaccine and menstrual changes among vaccinated and non-vaccinated adolescent female.

Research questions:

- 1- What are the menstrual changes reported after the Covid-19 vaccine among adolescent female?
- 2- Is there a relation between Covid19 vaccine and menstrual changes among vaccinated and non-vaccinated adolescent female?
- 3- What are the menstrual changes among vaccinated and non-vaccinated adolescent female?

Operational definition:

Menstrual changes: Menstrual changes are the greatest common gynecologic illnesses and affected the health, psychological and social status of adolescent female.

COVID-19 vaccine: Vaccination is one of the most effective methods of controlling the COVID-19 pandemic by building herd immunity within the population.

Subjects and Methods:

Research design:

A descriptive comparative cross-sectional research design was utilized in the present study.

Setting:

The current study was conducted at Beni-Suef City. According to 2022 estimates 3 million and 518 thousand people (74% in rural areas and 26% in urban areas). Beni Suef is a governorate with an area of 10,954 km², the capital of Beni-Suef Governorate is Beni-Suef City, and situated 120 km south to Cairo and constituted of an urban Metropolitan surrounded by 39 villages.

Sampling

Sample type: A convenient sample was used in this study.

Sample size: 412 adolescent female students' equally divided to control and study groups in the

age range from ≥ 18 - ≤ 25 years old through Google form spreadsheet during the beginning of October 2021 and completed by the end of January 2022. Their number (125555) adolescent female in Beni-Suef governorate reached to 412 in the study. Beni-Suef City (urban and rural area) were classified into strata according to their location on the map (North, West, and South), and two villages and urban Metropolitan were selected randomly. The sample size was calculated based on the formula of **IndiKit (2022)** for determining sample size for finite population. (N=384)

$$SS = \frac{Z^2 p(1-p)}{c^2}$$

Where:

Z = Z value (1.96 for a 95% confidence level)

p = percentage picking a choice or response (the calculator uses 0.5)

c = confidence interval, expressed as a decimal (e.g. 0.05 = ± 5)

Inclusion criteria:

- Age range from ≥ 18 - ≤ 25 years old.
- Adolescent female who had technology experience (Facebook& WhatsApp)
- Adolescent female who were receiving any type of COVID-19 vaccine.
- Adolescent female who had regular menstrual cycle at least three menstrual cycles before receipt COVID-19 vaccine.
- Free from mental, gynecological and chronic disease

Exclusion criteria:

- Adolescent female wasn't diagnosed with endocrine disorders or any type of bleeding disease which can cause menstrual disorders.
- Adolescent female disagree to participate in this study.

Tools of data collection:

Data was collected using an online questionnaire to fulfill this study. It was developed by the researcher after reviewing related literature and consists of three tools:

Tool 1: Structured interviewing questionnaire:

Demographic data of adolescent female, it consisted of three main parts, using Google form was designed by the researcher in simple Arabic language after reviewing related literature. **It included the following parts:**

- **Part I: Socio-demographic characteristics** (age, marital status, place of residence, and occupation).
- **Part II: Covid -19 vaccine status:** Included not receiving covid 19 vaccine, BioNTech, Pfizer vaccine, Johnson vaccine, AstraZeneca vaccine, and Sinopharm BBIBP vaccine

Tool II: Assessment of menstrual characteristics: It included the following parts:

Part 1: Menstrual changes after Covid-19 vaccine:

The items of this questionnaire were formulated based on the research objectives and review of literature: Including Any changes in the date of the menstrual cycle, regularity/ or irregularity of the menstrual cycle, cycle length, duration of menses intervals (<21, 21–24, 25-30 >35 days), cycle length less than 21 or more than 35 days, average days of menstruation (<3, 3–5, >5 days), and associated symptoms as back pain, vomiting, nausea

Part II: The menstrual pictogram: (Adopted from Wyatt et al., 2001).

It was determining the amount of blood lost during menstruation. This chart consists of a series of diagrams representing mild, moderately and severe or heavily soiled tampons or towels. A numerical scoring system was devised to coincide with the amount of blood lost. The scores assigned were 0.5 – 4 for each light (regular) stained tampon, if heavy (super) soiled (1-80). The towels were given ascending scores of(1-5) for day time and for night time (1,3 , 6, 10 , 15) Small , moderate and large clots scored 1 ,3 and 5. Finally for toilets light, moderate and heavy (1, 3, 5).

First day of menstruation: / / Please fill in the number of hygienic material you have used for each day of your menstruation period.

Towels	Type	Score in ml.	D1	D2	D3	D4	D5	D6	D7	D8
1	Day time	1								
	Night time	1								
2	Day time	2								
	Night time	3								
3	Day time	3								
	Night time	6								
4	Day time	4								
	Night time	10								
5	Day time	5								
	Night time	15								

Tampons	Type	Score in ml.	D1	D2	D3	D4	D5	D6	D7	D8
1	Regular	0.5								
	Super	1.0								
2	Regular	1.0								
	Super	1.5								
3	Regular	1.5								
	Super	3.0								
4	Regular	4.0								
	Super	8.0								

Towels	Score in ml.	D1	D2	D3	D4	D5	D6	D7	D8
1	1								
3	3								
5	5								

Clots	Score in ml.	D1	D2	D3	D4	D5	D6	D7	D8
1	1								
3	3								
5	5								

Date of control: / / Score: / / ml.
Investigator's signature: _____

Part III: Visual Analogue Scale (VAS): Visual analogue scale is adapted from (Aslan & Öntürk, 2015):

It was determining the severity of menstrual disorder by measuring in centimeters from the left of the line with the range 0-10. The women's pointed marks on the scale and the numerical value obtained indicate the intensity of pain. VAS is reported to be more sensitive and reliable in measuring pain intensity in comparison to other one-dimensional scales. Also, Data about characteristics of menstrual pain. It consists of 5 questions such as pain time, site, and intensity, doctor visit for menstrual problem and methods for pain relief. (Developed by the researcher after reviewing research literatures).

Scoring System for answer: It was translated to the corresponding pain intensity as follows:

- Grade 0:** Menstruation is not painful
- Grade 1: Mild (≤ 5):** Menstruation is painful, inhibits normal activity and relief by analgesics.

Grade 2: Moderate (6–7); Daily activity is affected; and relief by analgesics.

Grade 3: Severe (≥8); Activity clearly inhibited; and symptoms associated with menstruation (headache, fatigue, vomiting, and diarrhea).

Tool III: Beck Anxiety Inventory (BAI):

It was used as a data collection device in this study. The (BAI) adopted by (Beck et al., 1988), which was developed to determine the severity of the anxiety symptoms, this scale consists of 21 questions and total scores range between 0 and 63.

Scoring: It consists of 21 items that investigate symptoms of anxiety on a four-point Likert scale ranging from 0 = "not at all" to 3 = "severely." The anxiety level was scored using ordinal categories:

- Minimal (1–5 points).
- Mild (6–15),
- Moderate (16–30).
- Severe (31–63).

Validity

The validity of tool content was established by a panel of 5 expertise (two experts' in Obstetrics and Gynecology nursing department and one in community nursing department and two expertise from the faculty of medicine at Beni-Suef University) to check the clarity, applicability, and comprehensiveness of the questions. Recommended modifications were done accordingly, and the final form was modified.

Reliability:

The reliability of the tool was tested using Cronbach's alpha coefficients which was (0.832) which indicated a good level of internal consistency.

Operational Design:

The operational design for this study included three phases preparatory phase, pilot study, and fieldwork.

Phase1: -Preparatory phase

The researcher reviewed related literature of the current study, national & international, using textbooks, articles, and scientific journals. This review was helpful to the researcher in reviewing and developing the data collection tools, and then the researcher made any needed modifications to the tools of data collection after their revising by expertise.

Phase11: A pilot study

It was carried out on 10% of the sample for modification, clarification, and detection any possible obstacles that might face the researcher and interfere with data collection. Unclear items were clarified, unnecessary items were omitted, and new items were added. Those who shared in the pilot study were not excluded from the study sample.

Phase111: Fieldwork

Data collection of the study was conducted during the beginning of October 2021 and completed by the end of January 2022 through an online Arabic questionnaire. In the beginning, the researcher prepared for the study by reviewing the recent literature searching the same research problem national and worldwide. Egyptian Government guidelines to decrease face-to-face communication to avoid the risk of transmission of Covid-19 infection. Therefore, the researcher designed a semi-structured questionnaire using online Google forms and we generate the link that was shared on social media Facebook groups and WhatsApp. Adolescent female were informed about the objective, tools contents regarding this study, and how to answer on the first page of the online questionnaire. Then, Recipients who accepted to participate in this study complete the questionnaire through the link, also that they could quit participating at any time with no consequence. Then, recipients were randomly assigned to a study group that received a Covid-19 vaccine and control group that not received Covid-19 vaccine. The average time spent for adolescent female completing the questionnaire was approximately 20-25 minutes approximately. The time classified to (10 minutes)for the overview about socio-demographic status , the first tool will take (5-7 minutes), second tool part I (5 min), part II (3-5), part III (5 min). The research was conducted to collect data related to the socio-demographic status, and information about associating symptoms and menstrual changes was performed using tools (I) assessment of menstrual changes through physical and psychological symptoms for each one in brief manner. Also, adolescent female was assessed for level of pain using tool (II) and determine the severity of the anxiety symptoms using tool (III). Then, there was another statement on first page that includes the researchers' names and contact details through telephone number, Facebook and WhatsApp to allow adolescent female to contact with researcher if they had any concerns regarding the questionnaire sheet.

Ethical Consideration

Before the research started, Approval of the Ethical Research Committee of the Faculty of Medicine Beni-Suef University was obtained before conducting the study. The questionnaires included explanations about the purpose of the study and its consequences with confirming confidentiality of data. On the first page informed about the consent and purpose of the study were included in the questionnaire and an opening sentence showed that their participation is voluntary, and they have the right to withdraw from the study at any time and without giving any reason.

Administrative Design

Official letter was done and obtained through an issued letter from the Dean of faculty of Nursing Beni-Suef University for data collection.

Statistical analysis:

Data were analyzed using the software, Statistical Package for Social Science, (SPSS) version 20, then processed and tabulated. Frequency distribution with its percentage and descriptive statistics with mean and standard deviation were calculated. Chi-square, t-test, and correlations were done whenever needed. P values of less than 0.05 were considered statistically significant.

Result

Table (1): Percentage distribution of demographic characteristics among Studied Subjects.

Demographic Characteristics.	Non-vaccinated (n=206)	Vaccinated (n=206)	X ²	P-value
	N (%)	N (%)		
Age			1.431	0.489
- <20	55 (26.7)	45 (21.8)		
- ≥20 - <23	75 (36.4)	83 (40.3)		
- ≥23 - <25	76 (36.9)	78 (37.9)		
Mean±SD	21.31±2.38	21.48±2.27		
Residence			1.280	0.258
- Rural	127 (61.6)	138 (67)		
- Urban	79 (38.4)	68 (33)		
Marital status			5.894	0.053
- Single	115 (55.8)	130 (63.1)		
- Married	91 (44.2)	73 (36.9)		
Occupation			2.237	0.525
- Working	79 (38.4)	93 (45.1)		
- School student	24 (11.6)	21 (10.2)		
- University student	60 (29.1)	57 (27.7)		
- Not working	43 (20.9)	35 (17)		

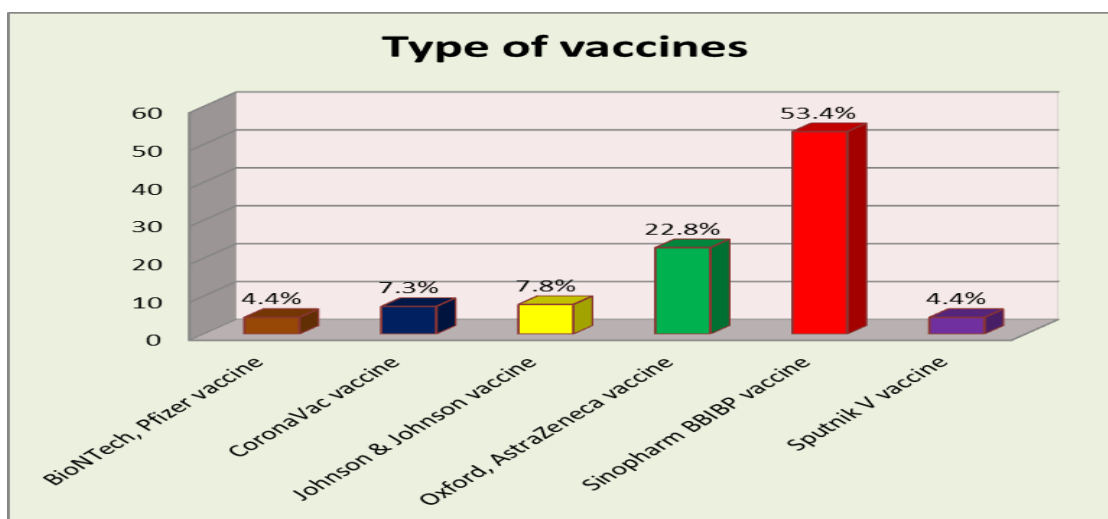


Figure (1): Type of vaccines used by study subjects (n=206)

Table (2): Comparing menstrual characteristics among Studied Subjects.

Menstrual characteristics	Non-vaccinated (n=206)	Vaccinated (n=206)	X ²	P-value
	N (%)	N (%)		
The date of the menstrual cycle				
- No changes	8 (3.9)	12 (5.8)	21.236	0.000**
- Early	71 (34.5)	36 (17.5)		
- Delay	127 (61.6)	158 (76.7)		
Regularity				
- Regular	72 (35)	59 (28.6)	1.891	0.169
- Irregular	134 (65)	147 (71.4)		
Number of spontaneous menstruations per year				
- <3	47 (22.8)	6 (2.9)	40.398	0.000**
- ≥3 - <6	12 (5.8)	21 (10.2)		
- ≥6 - <9	12 (5.8)	22 (10.7)		
- ≥9 - ≤12	123 (59.8)	149 (72.3)		
- ≥13	12 (5.8)	8 (3.9)		
Menstrual intervals				
- 21 – 24 days	91 (44.2)	50 (24.3)	70.468	0.000**
- 25 – 28 days	24 (11.7)	95 (46.1)		
- 29 – 32 days	67 (32.5)	29 (14)		
- More than 32 days	24 (11.6)	32 (15.6)		
Menstrual duration				
- Less than 3 days	12 (5.8)	17 (8.2)	44.650	0.000**
- Between 3 and 5 days	68 (33)	110 (53.4)		
- More than 5 days	126 (61.2)	79 (38.4)		
Number of pads used during menstruation				
- 1 – 2 pads	124 (60.2)	83 (40.3)	19.365	0.000**
- 3 – 4 pads	67 (32.5)	87 (42.2)		
- 5 pads or more	15 (7.3)	36 (17.5)		

** Highly statistically significant at $p < 0.01$

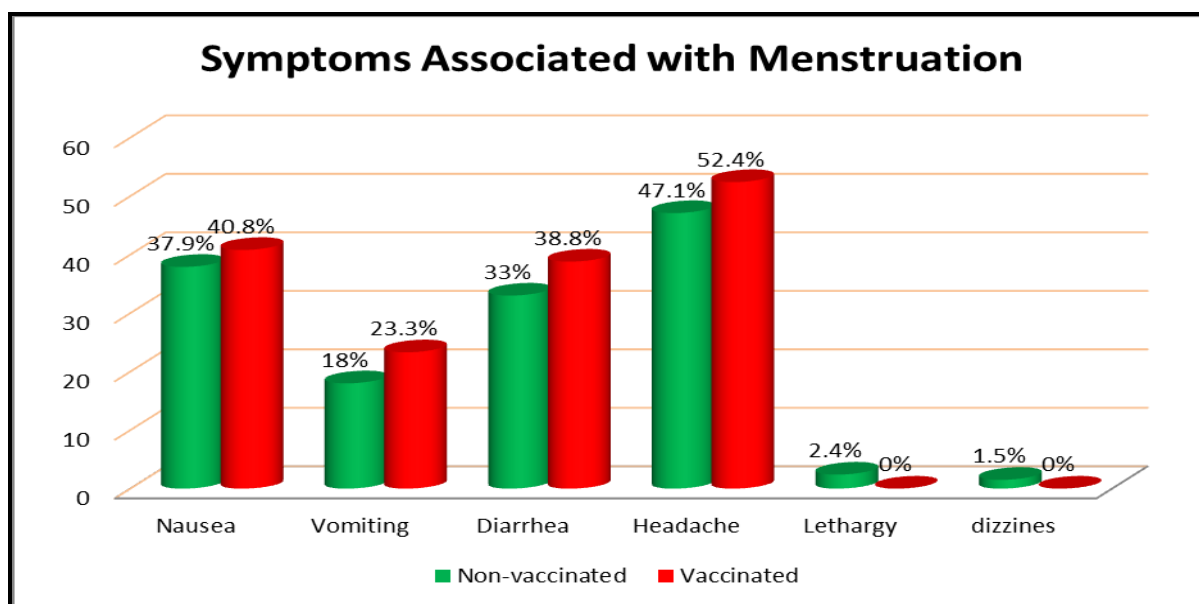


Figure (2): Symptoms associated with menstruation among studied subjects.

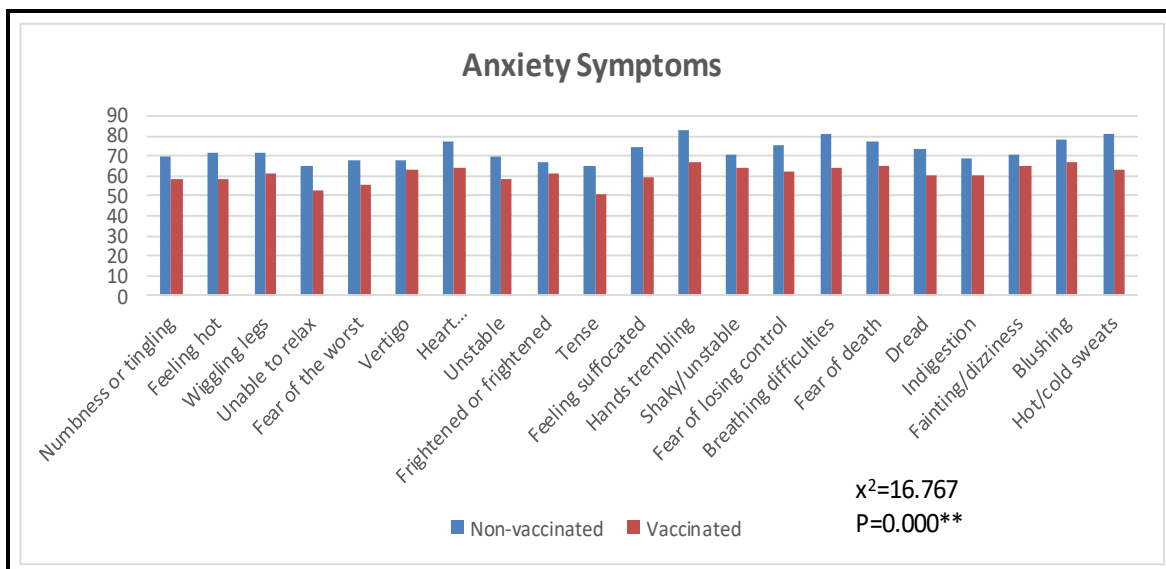


Figure (3): Anxiety symptoms among study subjects.

Table (4): Regression between Non-Vaccinated and Vaccinated Women and their Blood Loss, Pain, and Regularity of Menstruation’ symptoms severity and anxiety among Studied Subjects.

	(Constant)	Regression coefficients	R square	F	P-value
Blood loss	2.073	-0.301	0.045	20.176	0.000**
Pain	1.534	-0.005	-0.002	0.003	0.957
Regularity(a)	1.223	0.063	0.002	1.891	0.170
Symptom’s severity	9.456	3.432	0.049	22.377	0.000**
Anxiety	13.015	4.903	0.045	20.294	0.000**

Predictor: vaccination status.

Dependent variables: blood loss, pain, regularity, symptoms severity, anxiety.

Table (1): Summarized the percentage distribution of demographic characteristics among studied subjects. The mean age for vaccinated group was (21.48±2.27) while for non-vaccinated was (21.31±2.38). The majorities of vaccinated subjects were rural and single (67% and 63.1%) respectively while more than half of the non-vaccinated were rural and single (61.6% and 55.8%) respectively. Concerning subjects’ occupation, about half of vaccinated group (45.1%) was working while more than one third of non-vaccinated (38.4%) were working. Using chi square test, there were non-significant statistical differences between both vaccinated and non-vaccinated groups which means that both groups had similar demographic characteristics.

Figure (1): Illustrated the type of vaccine used by vaccinated group. More than half of the vaccinated group (53.4%) was vaccinated by Sinopharm BBIBP vaccine. Only small percentages of them were vaccinated by BioNTech Pfizer and Sputnik V vaccine (4.4%).

Table (2): Displayed the comparison of menstrual characteristics among Studied Subjects. The majority of both vaccinated and non-vaccinated group had delay date of menstrual cycle (76.7 % and 61.6 %) respectively. The majority of vaccinated and non-vaccinated groups had irregular cycles (65% and 71.4%) respectively. About two thirds of non-vaccinated (59.8%) and about three quarters (72.3%) of vaccinated group had between 9 and 12 spontaneous menstrual cycles per year. Regarding menstrual intervals, nearly half of vaccinated group (46.1%) had 25 to 28 days and also about one half of non-vaccinated group (44.2%) had interval between 21 and 24 days. Concerning number of pads used during menstruation, the majority of vaccinated (42.2%) used 3 to 4 pads while the majority of non-vaccinated (60.2%) used 1 to 2 pads. Using Chi square test, there were significant statistical differences between vaccinated and non-vaccinated group regarding all menstrual cycle characteristics (date, spontaneous menstruation per year, interval,

duration, number of pads used) except for regularity which was not significant statistically.

Table (3): Displayed the comparison between studied subjects regarding their menstrual associated pain. There were significant statistical differences between vaccinated and non-vaccinated subjects regarding pain time, site, intensity, doctor visit for menstrual problem and methods for pain relief while the difference between both groups concerning associated symptoms were non-significant. This means that both groups were different regarding menstrual pain while both groups had similar symptoms associated with menstrual pain.

Figure (2): Illustrated symptoms associated with menstruation among studied subjects. Nearly both groups of vaccinated and non-vaccinated adolescent female had similar symptoms. The highest percentages of symptoms among both vaccinated and non-vaccinated group were headache and nausea while the lowest percentage of symptoms associated with menstruation were for lethargy and dizziness.

Figure (2): Showed the anxiety symptoms among study subjects. There were significant statistical differences between vaccinated and non-vaccinated group regarding their anxiety symptoms ($X^2=16.767$, $P=0.000$).

Table (4): Summarized the Regression analysis between Non-Vaccinated and Vaccinated Women and their Blood Loss, Pain, and Regularity of Menstruation symptoms' severity and anxiety. The regression model was highly significant for predicting blood loss ($F=20.176$, $P=0.000$), symptoms severity ($F=22.377$, $P=0.000$), and anxiety ($F=20.294$, $P=0.000$). The vaccination explained 4.5 % of the variance in blood loss ($R^2=0.054$), 5% of the variance in symptoms severity ($R^2=0.049$), and 4.5% of the variance in anxiety ($R^2=0.045$) among studied subjects. The regression analyses for pain and regularity were non-significant statistically.

Discussion

COVID-19 vaccine was one of the most efficient ways to protect against COVID-19. The menstrual cycle is an important component of the active reproductive life of a woman. Menstrual disorders are the most common gynecological problems and affected the health, psychological and social status of women. The effects extend beyond individual women to society, resulting annually in an important loss of productivity. (Aref et al., 2015). The current study aimed to assess menstrual changes associated with COVID-19 vaccine among adolescent females at Beni-Suef Governorate.

Regarding demographic and medical characteristics of the adolescent female the current study revealed that were the mean age for vaccinated group was

(21.48 ± 2.27) while for non-vaccinated was (21.31 ± 2.38). The majorities of vaccinated subjects were rural and single (67% and 63.1%) respectively while more than half of the non-vaccinated were rural and single (61.6% and 55.8%) respectively. Concerning subjects' occupation, about half of vaccinated group (45.1%) was working while more than one third of non-vaccinated (38.4%) were working. Using chi square test, there were non-significant statistical differences between both vaccinated and non-vaccinated groups which means that both groups had similar demographic characteristics. This finding was in agreement with Elnagar et al (2017) who reported that the age ranged from 18 to 24 years old with an average of 20.1 ± 1.2 and assessed the incidence of menstrual changes, their effect on the performance of students. In the same line (Ahmed. et.al. 2018), Who reported that in studies in Ireland and the United Kingdom, 18–24 years old were more reluctant to receive the COVID-19 vaccine. These findings are in disagreement with (Murphy, et al., 2021) who reported that the majority of studied employee does not accept the vaccine, whereas a recent cross-sectional survey in the KSA found that the percentage of respondents who would accept the vaccine to protect themselves from COVID-19 was more than quarter definitely yes and one third probably yes. Regarding the type of vaccine used by vaccinated group. More than half of the vaccinated group (53.4%) was vaccinated by Sinopharm BBIBP vaccine. Only small percentages of them were vaccinated by BioNTech Pfizer and Sputnik V vaccine (4.4%). The previous results are similar to those (Priya 2021), who reported that the type of vaccine received, of which only two had been approved for use in the UK at the time (Pfizer BioNTech/Oxford-AstraZeneca/Not sure), and the timing of the first vaccination (month/year) was included.

Concerning the menstrual characteristics, the current findings indicated that there are the majority of both vaccinated and non-vaccinated group had delay date of menstrual cycle (76.7 % and 61.6 %) respectively. The majority of vaccinated and non-vaccinated groups had irregular cycles (65% and 71.4%) respectively. These findings are in contrast with (Ezat et. al., 2022) in their study about the association between the Covid-19 Pfizer vaccine and the reported post-vaccination menstrual changes in citizen and resident women in KSA, who showed that half of the participants (50.9%) have experienced menstrual disorder after receiving Pfizer vaccines, whereas 49.1% have no changes. The majority of them (60.5%) were delayed in the date of their menstrual onset.

Regarding menstrual intervals, nearly half of vaccinated group (46.1%) had 25 to 28 days and also about one half of non-vaccinated group (44.2%) had interval between 21 and 24 days. In the same line (**Edelman, et al. 2022**) who reported that no significant change in cycle length for the unvaccinated app users. About two thirds of non-vaccinated (59.8%) and about three quarters (72.3%) of vaccinated group had between 9 and 12 spontaneous menstrual cycles per year. In the same line (**PINHO, 2021**) who found that a growing number of cases of COVID-19 vaccine-induced thrombosis associated with thrombocytopenia and in some cases bleeding, particularly with Janssen and AstraZeneca vaccines, these reported cases occurred mostly in women under the age of 60, within 2-3 weeks of receiving the vaccine.

There have several research studies that reported a woman received two vaccine doses within the same menstrual cycle, the change in length could increase to 2 days. These changes appear to end quickly, possibly as soon as the next cycle after vaccination, and do not show any cause for long-term physical or reproductive health concerns, according to the authors (**Alison Edelman, et al. 2022**). These findings are in contrast with (**Hunter, (2021)** who assessed some women in In UK, who reported temporary changes in their menstrual cycle after receiving the Coronavirus vaccine. Some women have reported heavier bleeding than usual, delayed periods, or unexpected vaginal bleeding. These findings are in accordance with **Adebimpe et al. (2016)** who added that menstrual patterns and disorders impact life among university students in South-Western Nigeria and postulated that slightly more than three-quarters of their sample had regular monthly menstrual flow patterns and about one quarter had an irregular cycle. This agreement is due to the convergence of the target population, age group nutritional status, and physical health.

Concerning number of pads used during menstruation, the majority of vaccinated (42.2%) used 3 to 4 pads while the majority of non-vaccinated (60.2%) used 1 to 2 pads. Using Chi square test, there were significant statistical differences between vaccinated and non-vaccinated group regarding all menstrual cycle characteristics (date, spontaneous menstruation per year, interval, duration, number of pads used) except for regularity which was not significant statistically. These finding disagreement with **Jaikhani et al. (2014)** who reported that patterns and disorder of menstrual cycle amongst the Adolescent Girls Residing in the Urban Slum of one third of them had moderate blood flow and less than one quarter had mild blood flow. In contrast (**Shiferaw et al. (2014)** studied menstrual problems and associated factors among adolescent girls at Bahir

Dar University and reported that nearly half of their sample had irregular menstruation.

These finding agreements with (**Alison Edelman, et al., 2022**) who reported that COVID-19 vaccination was linked to a less than 1-day change in menstrual cycle length after the first and second vaccine doses, compared with pre-vaccine cycles. Vaccination did not affect the actual number of days of menstrual bleeding.

Regarding menstrual associated pain, the current study reported that There were significant statistical differences between vaccinated and non-vaccinated subjects regarding pain time, site, intensity, doctor visit for menstrual problem and methods for pain relief while the difference between both groups concerning associated symptoms were non-significant. This means that both groups were different regarding menstrual pain while both groups had similar symptoms associated with menstrual pain. These findings are in agreement with the findings from **Elnagar et al. (2017)** who found that the majority of their sample started pain with the menstruation and lasted for the first 24 hours of their period and three-quarters of the pain radiated to the lower back while nearly half of them pain radiated to lower extremities, this similarity may be due to similar age group. These results were similar to **Kamel, et al, (2017)**, who mentioned that dysmenorrhea is the painful cramps that women feel before or during the menstrual period, and it's the most mutual gynecologic grievance affecting adolescent and young women as 61.95% reported pain in every menstrual cycle and 86 (38.05%) reported pain only in some cycles. For there more, same as **Vlachou, et al, (2019)** reported that 52.5% of students had severe pain. This may be due to a shortage of knowledge about pain management among students. These findings are agreed with **Karout, (2015)** who found that less than one-quarter of pain was in the abdomen, and one-third of the pain extended down to the thighs. This difference may be due to cultural differences in pain perception and variability in pain threshold.

Concerning the symptoms associated with menstruation among studied subjects. Nearly both groups of vaccinated and non-vaccinated adolescent female had similar symptoms. The highest percentages of symptoms among both vaccinated and non-vaccinated group were headache and nausea while the lowest percentage of symptoms associated with menstruation were for lethargy and dizziness. In the same line (**Lee KMN, et al., 2021**) who reported that types of concerns raised range from the cycle and menstrual changes to differences in menstrual-associated symptoms, unscheduled bleeding, and changes in the menstrual bleeding. Also, the same

line with **Gad, (2017)** who studied Abnormal Uterine Bleeding and Its Impact on Women's Life and reported that Women with abnormal bleeding reported negative consequences of symptoms on physical, psychological, and social aspects of their lives. Heavy bleeding interfered with home and social activities and work.

Concerning the relation between Vaccination Status and Anxiety Symptoms, The current study shows that there were significant statistical differences between vaccinated and non-vaccinated group regarding their anxiety symptoms ($X^2=16.767$, $P=0.000$), these finding agreement with **IsIK et al. (2016)** who studied Premenstrual syndrome and life quality in Turkish health science students and reported that Physical and mental symptoms of PMS and the severity of these symptoms in students affected the life scores in their study. In addition to **Demir, et.al., (2021)** who studied menstrual cycle affected by many factors such as weight gain, infection, anxiety, hormonal changes, and stress or long term and require treatment such as polycystic ovary syndrome. Also, **(Nagma, 2015)**, reported that Psychological stress is a known risk factor for hypothalamic hypogonadism, resulting in infrequent or absent menstruation.

These findings similar to a recent analysis of 18,076 menstrual cycles application users before and during the covid-19 pandemic that also demonstrated no population-level cycle timing disruptions due to covid-19 stress. **(Nguyen, et al., 2021)** who assessed women's receiving the COVID-19 vaccine to not experience a longer but temporary cycle length change. Coronavirus disease 2019 (COVID-19) vaccination is not associated with changes in menses length. But other possible changes in menstrual cycles, such as menstrual symptoms, unscheduled bleeding, and changes in the quality and quantity of menstrual bleeding.

Furthermore, regarding the correlation between Non-Vaccinated and Vaccinated Women and their Blood Loss, Pain, and Regularity of Menstruation with the Type of Vaccine, the current study shows that there was highly statistically significant at $p \leq 0.01$. These results were in the same line with **(Katharine, et.al 2021)** who reported that the increased bleeding phenotype appeared to be the most common post-vaccination change. The present study agreement with **(Nguyen, et al., 2021)** who assessed that women's receiving the COVID-19 vaccine to not experience a longer but temporary cycle length change. Coronavirus disease 2019 (COVID-19) vaccination is not associated with changes in menses length. But other possible changes in menstrual cycles, such as menstrual symptoms, unscheduled bleeding, and changes in the quality and quantity of menstrual bleeding.

Conclusion:

The present study showed that COVID-19 vaccine is associated with a small change in menstrual cycle. The majority of vaccinated group had delay in the date of menstrual cycle, on the other hand, about two thirds of non-vaccinated and about three quarters of vaccinated group had between 9 and 12 spontaneous menstrual cycles per year.

Recommendation:

The following recommendations were suggested based on the results of the present study

- 1- Conduct a health education program to increase awareness about these possible menstrual changes following COVID-19 vaccination.
- 2- Further studies are needed to determine an association between the Covid-19 vaccine and menstrual changes.
- 3- Replication of the study on the large sample selected from different environmental areas in Egypt is recommended to find an association between the COVID-19 vaccine and other health-related exposures to adolescent female menstrual health.

Limitation of the study

- 1- When comparison of the Beni-suef city to the rest of cities in the Government, found that Beni-Suef City has different in socio-economic, level of education and The distribution of the population within the governorates so that, The sensitivity of the topic and the conservative nature of the community have resulted in low response rate (70%), and adolescent female who refused to respond might carry different characteristics.
- 2- It may be related to internet access.
- 3- This questionnaire using Google forms and we generate the link that was shared on social media, so we could not exactly measure the changes of the menstrual cycle, and left this parameter as a subjective evaluation from the adolescent female perspective

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