Original article

Menstrual Cycle Changes Following COVID-19 Infection and Vaccination: Associations with Demographic and Reproductive Factors in Libyan Women

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Abstract
COVID-19 infection and vaccination have been central to the global pandemic experience, with both associated with systemic effects extending beyond the respiratory system. Nonetheless, emerging reports have raised concern about possible menstrual disturbances, with implications for women's well-being and quality of life. This study investigated how COVID-19 infection and vaccination influence the menstrual cycle and examined their relationships with demographic, clinical, and reproductive characteristics. A cross-sectional survey was carried out from July to October 2023, including 182 female students aged ≥18 years who had previously regular menstrual cycles and no history of chronic illness. Data were collected using a validated 26-item self-administered questionnaire addressing demographics, COVID-19 history, vaccination status, and menstrual features. Statistical analyses were performed using SPSS version 25. Group differences were evaluated with t-tests, and associations between categorical variables were assessed using the Chi-square (x^2) test. Statistical significance was set at $p < 0.05$. The participants had a mean age of 25.6 ± 3.2 years; most were aged 25–30 years (68.1%) and unmarried (79.1%). Mean weight, height, and BMI were 65.3 ± 14.2 kg, 161.9 ± 5.9 cm, and 24.8 ± 4.8 kg/m², respectively; 9.3% reported comorbidities. Overall, just over half of the participants (51.6%) reported a previous COVID-19 infection, with the majority occurring more than a year before the survey. Vaccination coverage was high, with 79.1% having received at least one dose, most commonly AstraZeneca (18.8%) or Sputnik V (18.1%). Among those vaccinated, one-third (33.3%) experienced no adverse effects, whereas the most frequently reported reactions were local heaviness at the injection site (20.8%), fatigue (18.8%), and fever (13.9%). Menstrual changes were noted in 33% of women with a history of infection and in 18.1% of vaccinated participants, predominantly affecting cycle length, bleeding volume, and dysmenorrhea. Of note, more than half of affected individuals (56.1%) continued to experience these changes at the time of the survey. No significant differences were observed in the pattern of alterations between infected and vaccinated groups. In participants with previous infection, menstrual changes were significantly associated with higher weight (p = 0.01), cycles exceeding 35 days (p = 0.03), menses longer than seven days (p = 0.02), oral contraceptive use (p = 0.04), and infection within the preceding six months (p = 0.002), with BMI showing an association at the threshold of statistical significance (p = 0.05). No associations were identified with age, marital status, comorbidities, or treatment setting. Among vaccinated participants, menstrual changes were not linked to demographic or clinical variables, vaccine type, or number of doses. In summary, menstrual changes appeared more frequent after COVID-19 infection than after vaccination. Moreover, infection-related alterations were influenced by anthropometric and reproductive characteristics, whereas vaccination was not significantly associated with menstrual outcomes.
Keywords. COVID-19 Infection, SARS-CoV-2, Menstrual Cycle Changes, COVID-19 Vaccination, And Libya.

Introduction
Coronavirus Disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, has posed an unprecedented challenge to global health. COVID-19 vaccination campaigns have been instrumental in reducing severe illness, hospitalizations, and mortality, while also strengthening community protection and contributing to the overall recovery of public health systems. Beyond their direct protective role, these efforts underscore the broader societal importance of immunization in controlling emerging infectious threats and have raised questions about possible effects on diverse aspects of health, including reproductive function [1–3].
The menstrual cycle is a tightly regulated physiological process and a recognized indicator of both reproductive and general health. Disturbances in cycle length, flow, or duration may influence physical and psychological well-being, impair quality of life, and heighten concerns regarding fertility [4,5]. Given the sensitivity of menstrual function to biological, environmental, and lifestyle influences, evaluating how novel medical interventions such as COVID-19 vaccination may affect this process is of considerable importance.
While COVID-19 vaccines are highly effective at inducing protective immune responses, both anecdotal accounts and emerging studies have reported temporary changes in menstrual patterns following vaccination. Reported alterations include menorrhagia, metrorrhagia, and polymenorrhea, with some

research noting heavier bleeding and longer cycle duration among fully vaccinated women [6,7]. Although the body of international evidence on this topic is expanding, data from Libyan populations remain limited, emphasizing the need for region-specific investigation. Accordingly, the present study was designed to evaluate the effects of COVID-19 infection and vaccination on menstrual cycle characteristics and to determine their associations with demographic, clinical, and reproductive factors.

Methods
This cross-sectional study was carried out between July and October 2023 at the Faculty of Medicine, Benghazi University. The study population consisted of fourth- and fifth-year medical students aged ≥18 years who reported regular menstrual cycles. Inclusion criteria required a self-reported baseline cycle length of 28 ± 7 days before COVID-19 infection or vaccination and the absence of any chronic medical conditions. Students younger than 18 or those with pre-existing irregular cycles, were excluded. The sample size was determined using OpenEpi, assuming a 95% confidence level. A pilot study was conducted to ensure clarity and appropriateness of the questionnaire before administration. Data were collected using a validated, self-administered 26-item questionnaire in Arabic. The instrument included sections on demographic characteristics, COVID-19 infection history, vaccination status, and menstrual cycle features. Menstrual parameters assessed were cycle length, duration, and bleeding volume. For analysis, cycle length was classified as short (<21 days), normal (21–35 days), or delayed (>35 days). Menstrual duration was classified as short (<3 days), normal (3–7 days), or prolonged (>7 days), while bleeding volume was categorized as light, normal, or heavy. Data were entered and analyzed using SPSS version 25. Continuous variables were presented as mean ± standard deviation (SD) with ranges, whereas categorical variables were summarized as frequencies and percentages. Comparisons of continuous variables between groups were conducted using independent t-tests, and associations among categorical variables were examined using the Chi-square (x^2) test. A p-value <0.05 was considered statistically significant.

Results
General characteristics
A total of 182 completed questionnaires met the inclusion criteria and were analyzed (Table 1). The mean age of participants was 25.6 ± 3.2 years. Most were between 25 and 30 years (68.1%, n = 124), followed by 18–25 years (22.0%, n = 40), while a smaller proportion were older than 30 years (9.9%, n = 18). The majority were single (79.1%, n = 144), whereas 20.9% (n = 38) were married. Anthropometric data showed a mean weight of 65.3 ± 14.2 kg (range: 41–104 kg), a mean height of 161.9 ± 5.9 cm (range: 145–175 cm), and a mean Body Mass Index (BMI) of 24.8 ± 4.8 kg/m² (range: 16.2–39.7 kg/m²). The prevalence of comorbid conditions among participants was 9.3% (n = 17), with diabetes and thyroid disorders being the most common. Regarding menstrual characteristics, the majority reported regular cycles of 21–35 days (76.4%, n = 139) and menstrual duration of 3–7 days (87.9%, n = 160). Among married participants, the prevalence of contraceptive use was 57.9% (n = 22), with barrier methods being the most prevalent and combined oral contraceptives (COCs) the next most common.

Table 1. Demographic, anthropometric, and menstrual characteristics of participants

Characteristic	Mean ± SD	n (%)
Age (years)	25.6 ± 3.2	
18–25		40 (22.0%)
25–30		124 (68.1%)
>30		18 (9.9%)
Marital Status		
Single		144 (79.1%)
Married		38 (20.9%)
Anthropometric Data		
Weight (kg)	65.3 ± 14.2	
Height (cm)	161.9 ± 5.9	
BMI (kg/m²)	24.8 ± 4.8	
Comorbidities		17 (9.3%)
Menstrual Characteristics		
Regular Cycles (21–35 days)		139 (76.4%)
Menstrual Duration (3–7 days)		160 (87.9%)
Contraceptive Use (among married, n=38)		
Total Contraceptive Users		22 (57.9%)
Type of Contraceptive Method		
Barrier Methods		(Most prevalent)
COCs		(Next most common)

COVID-19 infection and vaccination

Of the study participants, 51.6% (n = 94) reported a previous COVID-19 infection. Most of these cases (90.4%, n = 85) had occurred more than one year before the survey, and only a small fraction (5.3%, n = 5) required hospitalization. Most participants (79.1%, n = 144) had received at least one dose of a COVID-19 vaccine, indicating high vaccination coverage. Among them, just over half (51.4%) had received a single dose, 38.9% had completed two doses, and 9.7% had received three doses. Reported vaccine types varied: AstraZeneca (18.8%, n = 27), Pfizer (10.4%, n = 15), Sinopharm (16.7%, n = 24), Sinovac (1.4%, n = 2), Johnson & Johnson (1.4%, n = 2), Sputnik V (18.1%, n = 26), and Sputnik Light (2.1%, n = 3). Mixed regimens were reported by 4.9% (n = 7), while 26.4% (n = 38) could not recall the vaccine type (Figure 1).
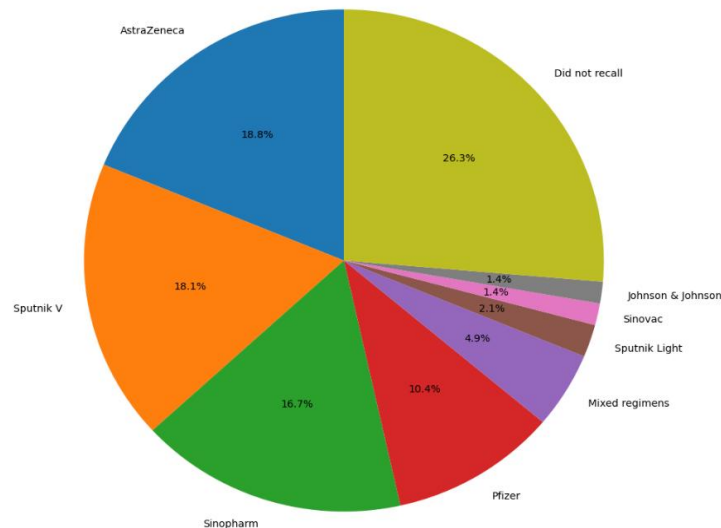

Figure 1. COVID-19 infection and vaccination status among study participants

Systemic side effects

As shown in Figure 2, among the 144 vaccinated participants, one-third (33.3%, n = 48) reported no adverse effects. The remainder experienced a range of post-vaccination reactions. The most frequently reported were local heaviness at the injection site (20.8%, n = 30), generalized fatigue (18.8%, n = 27), and fever (13.9%, n = 20). Less common effects included muscle aches (5.6%, n = 8), localized redness at the injection site (2.8%, n = 4), and a small number of other minor symptoms (4.9%, n = 7).
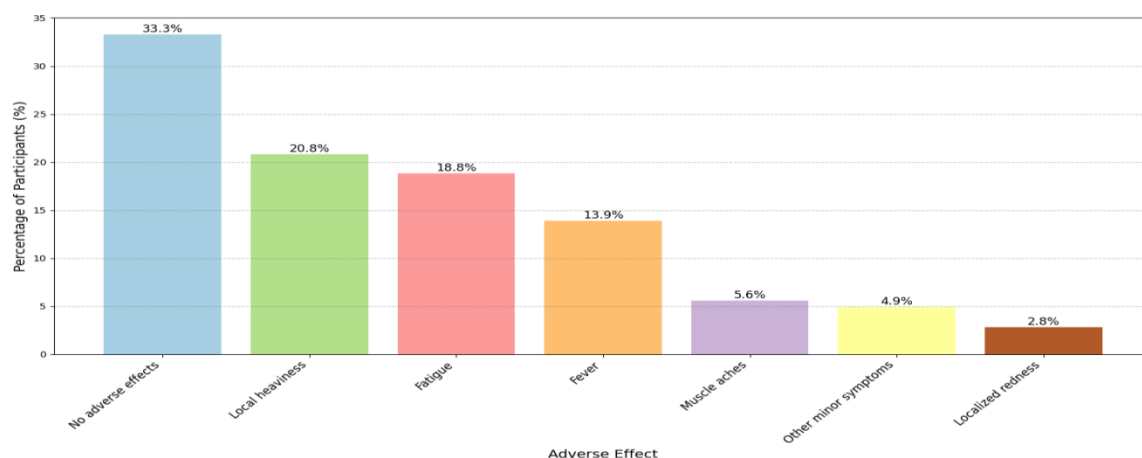

Figure 2. Post-COVID-19 vaccination adverse effects among vaccinated participants

Distribution of menstrual cycle changes

A history of COVID-19 infection was associated with menstrual changes in 33% (n = 31) of participants, while 18.1% (n = 26) of vaccinated participants reported similar alterations. The most frequently affected aspects included cycle length, bleeding volume, and dysmenorrhea. Over half of those experiencing changes (56.1%) continued to report menstrual disturbances at the time of the survey (Figure 3).
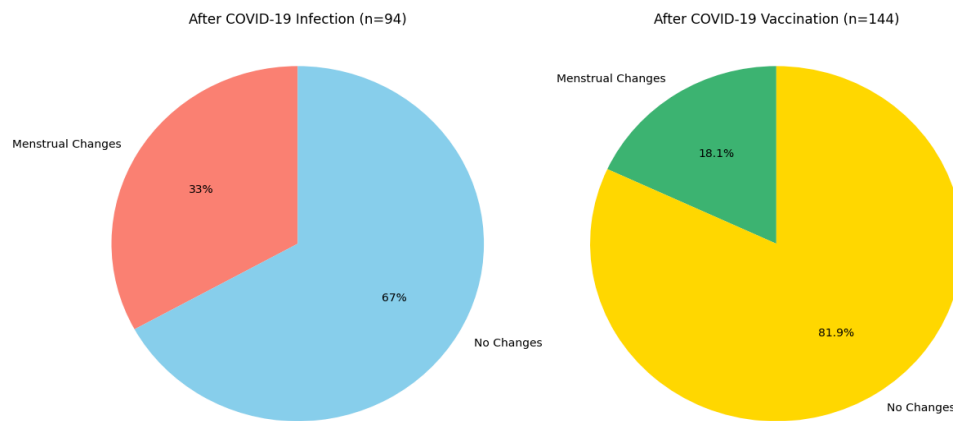
Figure 3. Prevalence of menstrual changes post-COVID-19 infection or vaccination.

Associations between menstrual changes and participant characteristics

In participants with a history of COVID-19 infection, menstrual changes showed significant associations with cycle lengths exceeding 35 days (p = 0.03), menses lasting more than seven days (p = 0.02), use of COCs (p = 0.04), and infection within the preceding six months (p = 0.002). While a trend was observed, the relationship with higher BMI (p = 0.05) reached the threshold of statistical significance. No significant relationships were observed with age, marital status, comorbidities, or treatment setting. In contrast, among vaccinated participants, menstrual changes showed no significant correlations with any measured factors, including vaccine type (p = 0.19), number of doses (p = 0.16), anthropometric characteristics, age, marital status, residence, comorbidities, cycle length, menses duration, or contraceptive use (Table 2).

Table 2. Demographic and clinical correlates of menstrual changes in infected vs vaccinated participants.

Characteristic	Menstrual Changes After COVID-19 Infection (p-value)	Menstrual Changes After COVID-19 Vaccination (p-value)
Body Weight	Significant (p = 0.01)	Not Significant
BMI	At the threshold of significance (p = 0.05)	Not Significant
Cycle Length >35 days	Significant (p = 0.03)	Not Significant
Menses >7 days	Significant (p = 0.02)	Not Significant
COC Use	Significant (p = 0.04)	Not Significant
Infection within 6 months	Significant (p = 0.002)	N/A
Vaccine Type	N/A	Not Significant (p = 0.19)
Number of Doses	N/A	Not Significant (p = 0.16)
Age	Not Significant	Not Significant
Marital Status	Not Significant	Not Significant
Comorbidities	Not Significant	Not Significant
Treatment Setting	Not Significant	Not Significant

Discussion

The present study from Benghazi, Libya, found that 18.1% of vaccinated participants reported menstrual changes, a prevalence that aligns with a growing international body of evidence documenting similar effects following COVID-19 vaccination. The observed prevalence is consistent with the 18% reported in a large retrospective study from the United Kingdom by Alvergne et al. and with the 15.1% documented in a Turkish cohort by Taşkaldıran et al. [8,9]. In contrast, a longitudinal study conducted in the United States by Farland et al. (2023) reported a slightly higher prevalence, with approximately 25% of vaccinated participants experiencing menstrual cycle changes [10].

The specific menstrual changes observed in this study—namely, alterations in cycle duration, bleeding volume, and dysmenorrhea—are consistent with the findings of Rodríguez Quejada et al., who reported irregular cycle frequency and a higher incidence of heavy or prolonged bleeding [11]. The reproducibility of these findings across diverse geographic and cultural contexts suggests that post-vaccination menstrual changes may be driven by a shared, albeit likely multifactorial, biological mechanism.

An important finding of the present study was that 33% of participants with a history of COVID-19 infection reported menstrual changes. This observation is broadly consistent with the results of Taşkaldıran et al., where 35.7% of women with prior COVID-19 infection experienced similar alterations in their menstrual cycles [9]. The current study extends these observations by demonstrating significant

associations between menstrual changes and higher body weight (p = 0.01), prolonged baseline cycle length (>35 days, p = 0.03), and longer menses duration (>7 days, p = 0.02), with BMI showing an association at the threshold of statistical significance (p = 0.05). Additional factors linked to menstrual changes included the use of COCs (p = 0.04) and a recent infection within the preceding six months (p = 0.002).

Conversely, Farland et al. found that participants with a history of COVID-19 infection were less likely to experience menstrual changes following vaccination (OR, 0.58; 95% CI 0.32–1.04) [10]. This difference may reflect variations in study populations, the timing of infection relative to vaccination, and methodological approaches, underscoring the complex and context-dependent nature of post-infection menstrual alterations.

Within the vaccinated cohort of this study, menstrual changes showed no significant associations with demographic or clinical variables, including vaccine type (p = 0.19), number of doses (p = 0.16), body weight, BMI, or contraceptive method. These findings differ from several international studies. For example, Farland et al. reported that higher BMI (OR, 1.04; 95% CI 1.00–1.07) and elevated perceived stress (OR, 2.22; 95% CI 1.12–4.37) were significantly associated with increased odds of post-vaccination menstrual changes [10]. Similarly, Alvergne et al. identified smoking and prior COVID-19 infection as significant risk factors (P < 0.01 and P < 0.001, respectively), whereas the use of oral contraceptives appeared protective (P < 0.001) [8]. The lack of similar associations in the Benghazi cohort may be attributable to regional demographic characteristics, local vaccine distribution patterns, or other unmeasured confounding factors. These results highlight the importance of considering population-specific variables when interpreting post-vaccination menstrual outcomes.

Menstrual changes were observed more frequently following COVID-19 infection than after vaccination. In women with a history of infection, higher body weight, prolonged cycle length, longer menses, recent infection, and use of COCs were associated with an increased likelihood of menstrual alterations. By contrast, vaccination showed no significant association with menstrual changes. These findings indicate that COVID-19 infection may have a broader impact on menstrual health, whereas vaccination appears largely unlinked. Continued monitoring and further research are warranted to clarify these effects.

While the current study contributes important evidence on the relationship between COVID-19 infection, vaccination, and menstrual health, several limitations warrant consideration. The reliance on self-reported menstrual data may have introduced recall bias, potentially influencing the precision of reported cycle characteristics. Moreover, as the sample was drawn exclusively from medical students at a single university, the findings may not fully capture the diversity of the wider population, thereby limiting external validity. Finally, the cross-sectional design constrains the ability to infer temporal or causal relationships, underscoring the need for prospective, longitudinal studies to clarify these associations more robustly.

Conclusion

Menstrual changes were more frequently reported following COVID-19 infection than after vaccination. Infection-related changes demonstrated significant associations with higher body weight and pre-existing cycle irregularities, whereas vaccination was not linked to such patterns. These findings indicate that COVID-19 infection may exert a more pronounced influence on menstrual health than vaccination. Nonetheless, further large-scale, longitudinal studies are needed to clarify underlying mechanisms and to determine the long-term implications for women's reproductive well-being.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this study.

Reference

1. Alfituri A, Shembesh A, Elhadi M, Gammoudi A, Elbarasi M, Abugrara A, et al. Complications following COVID-19 infection or vaccination in Libyan International Medical University students and their families. Asian J Med Appl Sci. 2024. doi: 10.54361/ajmas.2472003.
2. Mohammed I, Qureshi A, Khan M, Ali S, Hussain T, Rahman A, et al. The efficacy and effectiveness of the COVID-19 vaccines in reducing infection, severity, hospitalization, and mortality: a systematic review. Hum Vaccin Immunother. 2022;18(1):2027160. doi: 10.1080/21645515.2022.2027160.
3. Lee SW, Ma D. COVID-19 hospital length of stay, in-hospital death, and increased home discharge. Prev Med Rep. 2023;32:102152. doi: 10.1016/j.pmedr.2023.102152.
4. Vollmar AKR, Mahalingaiah S, Jukic AM. The menstrual cycle as a vital sign: a comprehensive review. F&S Rev. 2025;6(1):100081. doi: 10.1016/j.xfnr.2024.100081.
5. Attia GM, Alharbi OA, Aljohani RM. The impact of irregular menstruation on health: a review of the literature. Cureus. 2023;15(11):e49146. doi: 10.7759/cureus.49146.
6. Nazir M, Asghar S, Rathore MA, Shahzad A, Shahid A, Khan AA, et al. Menstrual abnormalities after COVID-19 vaccines: a systematic review. Vacunas. 2022;23 Suppl 1:S77–87. doi: 10.1016/j.vacun.2022.07.001.

7. Matar SG, Alshammari R, Alhassan M, Alzahrani N, Alharthi A, Alotaibi H, et al. Effect of COVID-19 vaccine on menstrual experience among females in six Arab countries: a cross-sectional study. Influenza Other Respir Viruses. 2023;17(1):e13088. doi: 10.1111/irv.13088.

8. Alvergne A, Kountourides G, Argentieri MA, Agyen L, Rogers N, Knight D, et al. COVID-19 vaccination and menstrual cycle changes: a United Kingdom (UK) retrospective case-control study. medRxiv [Preprint]. 2021. doi: 10.1016/j.isci.2023.106401.

9. Taşkaldıran I, Vuraloğlu E, Bozkuş Y, Turhan İyidir Ö, Nar A, Başçıl Tütüncü N. Menstrual changes after COVID-19 infection and COVID-19 vaccination. Int J Clin Pract. 2022;2022:3199758. doi: 10.1155/2022/3199758.

10. Farland LV, Khan SM, Shilen A, Heslin KM, Ishimwe P, Allen AM, et al. COVID-19 vaccination and changes in the menstrual cycle among vaccinated persons. Fertil Steril. 2023;119(3):392–400. doi: 10.1016/j.fertnstert.2022.12.023.

11. Rodríguez Quejada L, Toro Wills MF, Martínez-Ávila MC, Patiño-Aldana AF. Menstrual cycle disturbances after COVID-19 vaccination. Womens Health (Lond). 2022;18:17455057221109375. doi: 10.1177/17455057221109375.