

Original Research

Side Effects of COVID-19 Vaccines Among Jordanian Females: A Cross-Sectional Study

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Abstract

Background: The rapid development of the COVID-19 vaccine played a critical role in combating the SARS-CoV-2 pandemic. Global vaccination campaigns aimed to achieve widespread immunity, reduce transmission, and reduce mortality rates. However, concerns regarding the vaccine's safety and associated side effects persist, especially among women. Understanding these concerns and reporting the side effects is essential for public health strategies and building confidence in vaccination programs. **Methods:** A cross-sectional study was conducted to investigate the side effects experienced by Jordanian females. Participants were recruited via social media platforms. The developed study's survey consisted of demographic information and detailed questions about side effects after receiving the COVID-19 vaccine. Data were analyzed using the Statistical Package for Social Science (SPSS). **Results:** A total of 861 females, mainly young adults, participated in the study. Approximately 56% of participants reported side effects following the first dose, while 52.8% experienced side effects after the second dose. The most reported side effects were pain at the injection site, fatigue, and lethargy. Redness at the injection site, cough, and chest pain were more prevalent after the second dose. Residential area was significantly associated with experiencing side effects after the first dose; on the other hand, employment status was significant after the second dose. **Conclusion:** The present study offers valuable insights into the side effects of COVID-19 vaccines among females. These findings can inform public health strategies and enhance public confidence in vaccination programs in Jordan.

Keywords: Coronavirus; COVID-19 Vaccines; Side effects; Females; Jordan

INTRODUCTION

The rapid development of COVID-19 vaccines has been pivotal in combating the global pandemic caused by the novel coronavirus, SARS-CoV-2.¹ Vaccination campaigns worldwide, including those in Jordan, have strived to achieve widespread immunity to control transmission and decrease the severity of COVID-19 cases, thereby reducing the mortality rate.²⁻⁵ However, introducing any new vaccine raises concerns about safety and possible side effects, which must be systematically monitored and evaluated.⁶⁻⁸ In Jordan, as in many countries, monitoring vaccine safety involves rigorous surveillance to detect and assess any reported side effects among vaccinated individuals.⁹

Gender impacts vaccine acceptance, outcomes, and responses. Females are less likely to accept the vaccines initially, yet once

they receive the vaccine, they will develop a longer-lasting antibody response compared to males. Nevertheless, females are more likely to experience side effects with higher severity compared to males.¹⁰ Understanding these side effects, particularly among women, is crucial since specific factors like gender can influence vaccine responses and side effects.¹¹ This data is essential for optimizing public health strategies and building strong public confidence in Jordan's vaccination programs.¹² In light of the above, this study aimed to assess the side effects of COVID-19 vaccines among Jordanian females, providing insights that can guide healthcare providers, policymakers, and the public. Ultimately, these insights are crucial for informed decision-making and promoting confidence in vaccination as a cornerstone of public health strategy.

METHODS

Study design

A cross-sectional descriptive study was conducted in August 2021 to investigate the side effects experienced by Jordanian females after receiving COVID-19 vaccines. Data collection occurred through a digital survey developed and distributed using Google Forms.

The study's survey consisted of two sections that addressed different aspects. The first section was designed to collect the females' demographic characteristics and consisted of nine items. This section included questions on participants' age, marital status, education level, employment status, residential area, smoking status, medication use, history of chronic diseases, and prior COVID-19 infection. The second section

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focused on the side effects associated with the COVID-19 vaccine. It included questions (n=6) about the type of vaccine received, whether the females experienced side effects after the first and second doses, and the specific side effects reported.

Study participants

The study recruited Jordanian females who had received at least the initial dose of COVID-19 vaccines. Participation was voluntary, and no financial incentives were offered to minimize bias from self-selection. However, the potential contribution of the study to public education and reducing vaccine hesitancy was emphasized to participants before they provided informed consent.

Survey development

An extensive literature review identified various potential side effects associated with COVID-19 vaccines. The research team developed a survey instrument to align with the study's objectives. The survey initially included a broad pool of questions, then, it was refined to focus on the study's aim. An expert panel assessed the understanding, relevance, and word clarity of the questions in the initial draft of the survey to ensure face and content validity. Their feedback identified unclear or irrelevant items, prompting the research team to make necessary amendments.

Survey implementation

The research team recruited participants through social media platforms such as Facebook and WhatsApp. The survey, designed to be completed in an average of five minutes, presented the ethics committee approval for participants to review before they began.

Ethical approval

Ethical approval was provided after the study was examined by the Scientific and Ethics Committee of the Faculty of Pharmacy, Applied Science Private University.

Sample size

The sample size calculation determined that a minimum of 384 participants was needed to ensure representativeness. This calculation considered the number of vaccinated females in Jordan, a 5% margin of error, a 95% confidence level, and assumed a 50% response distribution.

Statistical analysis

Study data has been exported from Google Forms to a Microsoft Excel sheet, then imported and analyzed using the Statistical Package for the Social Sciences (SPSS), Version 24.0 (SPSS Inc., Chicago, IL, USA). The level of statistical significance was at a p-value of 0.05.

Descriptive statistics were used to analyze continuous variables' demographic data, mean, and standard deviation, whereas frequencies and percentages illustrated categorical variables.

The Shapiro-Wilk test tested the normality; a p-value >0.05 indicated a normally distributed continuous variable. A paired t-test was conducted to screen for the difference between the reported side effects scores after the first and second doses of the COVID-19 vaccine. The point-biserial correlation was used to determine whether there is an association between the score of symptoms and the dichotomous variables, presenting the Pearson correlation and p-values.

RESULTS

The recruited females (n= 861) were mainly young adults, as 37.4% were aged between 30 and 39 (n= 322), and 36.1% were aged between 18 and 29 (n= 311). More than 60% were married (n= 531). The majority resided in Jordan's center regions (n= 749). Regarding education, a high proportion (86.99%) held a Bachelor's degree or higher (n= 749). Half of the participants were employed (n= 431). With regards to their smoking habits, 70.6% were non-smokers (n= 608), 27.41% were current smokers (n= 235), and 2.1% (n=18) were former smokers (Table 1).

Table 1. Sociodemographic characteristics of the study participants (n=861).

Variable	n	%
Age		
· less than 18	3	0.35
· 18-29	311	36.12
· 30-39	322	37.4
· 40-49	172	19.98
· 50-59	45	5.23
· 60 or more	8	0.93
Marital status		
· Single	290	33.68
· Married	531	61.67
· Divorced	33	3.83
· Widowed	7	0.81



Residential areas		
· North	78	9.06
· Centre and capital (Amman)	749	86.99
· South	34	3.95
Education level		
· Primary School	5	0.58
· High School	41	4.76
· Diploma	66	7.67
· Bachelor's Degree	584	67.83
· Postgraduate Degree (Master's or PhD)	165	19.16
Employment status		
· Working	431	50.06
· Housewife	410	47.62
· Retired	20	2.32
Smoking status		
· Non-smoker	608	70.6
· Former smoker	18	2.1
· Current smoker	235	27.3
Chronic disease history		
· Allergy	164	19.05
· Asthma/COPD	35	4.07
· Hematological disorder	12	1.39
· Orthopedic and joint disorders	41	4.76
· GIT disorder	46	5.34
· Cancer	4	0.46
· Cardiac disorders	8	0.93
· Hypertension	40	4.65
· Diabetes type I	13	1.51
· Diabetes type II	17	1.97
· Nephrological disorders	7	0.81
· Thyroid disorder	74	8.59
· Neurological disorder	18	2.09
· No chronic disease history	382	44.36
Medication history		
· Common analgesics (e.g., Paracetamol)	238	27.64
· Nonsteroidal anti-inflammatory Drugs	49	5.69
· Opioid Analgesics	9	1.05
· GERD medication	30	3.48
· Anti-asthmatic	17	1.97
· Antihistamine	74	8.59
· Antibiotics	50	5.81
· Corticosteroid	4	0.46
· Thyroid Hormone	67	7.78
· Anti-Diabetics	37	4.3
· Anti-hypertensive	43	4.99
· Lipid-lowering agents	29	3.37



· Anticoagulant	11	1.28
· Antidepressant	25	2.9
· Anti-epileptic	5	0.58
· Contraceptive pills	35	4.07
· Immunosuppressants	5	0.58
· No medication history	133	15.45
Have you been infected with coronavirus before receiving your COVID-19 vaccine?		
· No	495	57.49
· Not sure	73	8.48
· Yes	293	34.03

Among the participants, 19.05% had allergies (n= 164), 8.59% had thyroid disorders (n= 74), 5.34% had gastrointestinal (GIT) disorders (n= 46), 4.76% had orthopedic or joint disorders (n= 41), and 4.65% had hypertension (n= 40). Medication use included common analgesics (27.64%, n= 238) and antihistamines (8.59%, n= 74). At the time of the study, 57.49% (n= 495) reported not receiving the COVID-19 vaccine before getting infected with the coronavirus (Table 1).

Regarding the type of COVID-19 vaccine received (Figure 1), Pfizer was the most received type for both the first and second doses (50% and 48%, respectively), followed by Sinopharm (32% and 40%, respectively), AstraZeneca (17% and 11%, respectively), and Sputnik V (1% for both doses). After the first dose of the COVID-19 vaccine, 55.5% of the females experienced side effects, while a lower percentage was reported after the second dose, as 52.8% experienced side effects (Figure 2).

Table 2 compares the side effects after both doses. The three most common side effects after both doses were pain at the injection site (85.1% and 30.4%, respectively), fatigue (86.2% and 31.5%), and lethargy (85.6% and 39.9%). Notably, a significantly higher percentage of participants reported redness

at the injection site, cough, and chest pain after the second dose compared to the first dose (p-values < 0.05). Conversely, a significantly higher percentage of participants reported pain at the injection site, swelling at the injection site, fatigue, lethargy in the body, headache, pain in muscles or joints, GIT symptoms, and drowsy after the first dose compared to the second dose (p-values < 0.05). Overall, the mean symptom score did not differ significantly between the two doses (8.7 ± 4.4 for the first dose vs. 8.1 ± 4.4 for the second dose, p-value =0.971).

Table 3 demonstrated that the first dose was significantly affected by the residential (p-value= 0.037). Moreover, employment status had a significant correlation with the symptom scores for the second dose (p-value= 0.044)

DISCUSSION

The current cross-sectional study investigated the side effects experienced by Jordanian females after receiving the COVID-19 vaccines, providing valuable insights to guide healthcare providers and policymakers. The study's findings highlighted certain significant themes related to demographics, the

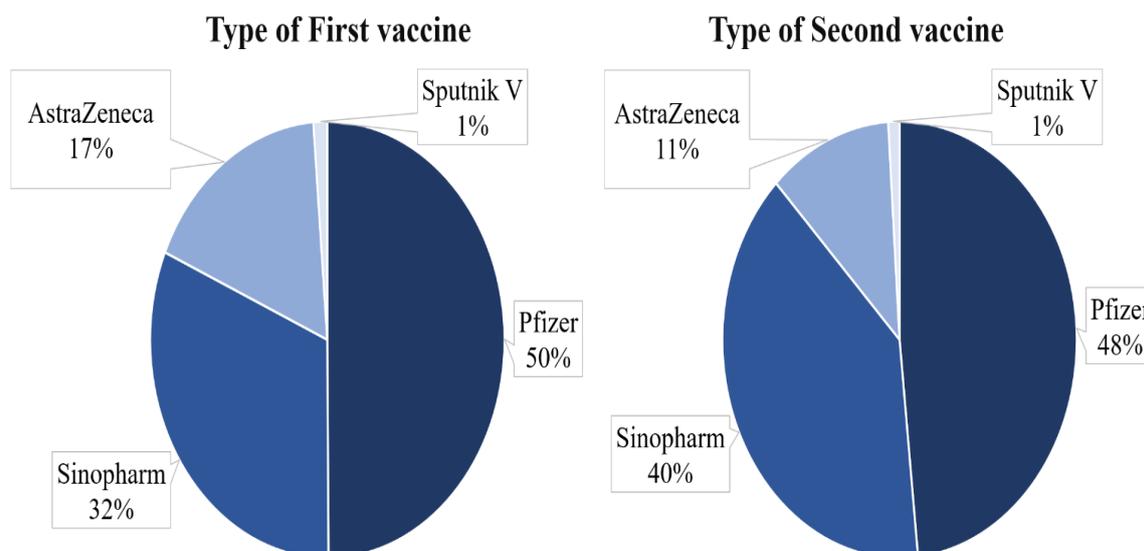


Figure 1. The type of the received COVID-19 vaccine among the participants (n= 861).

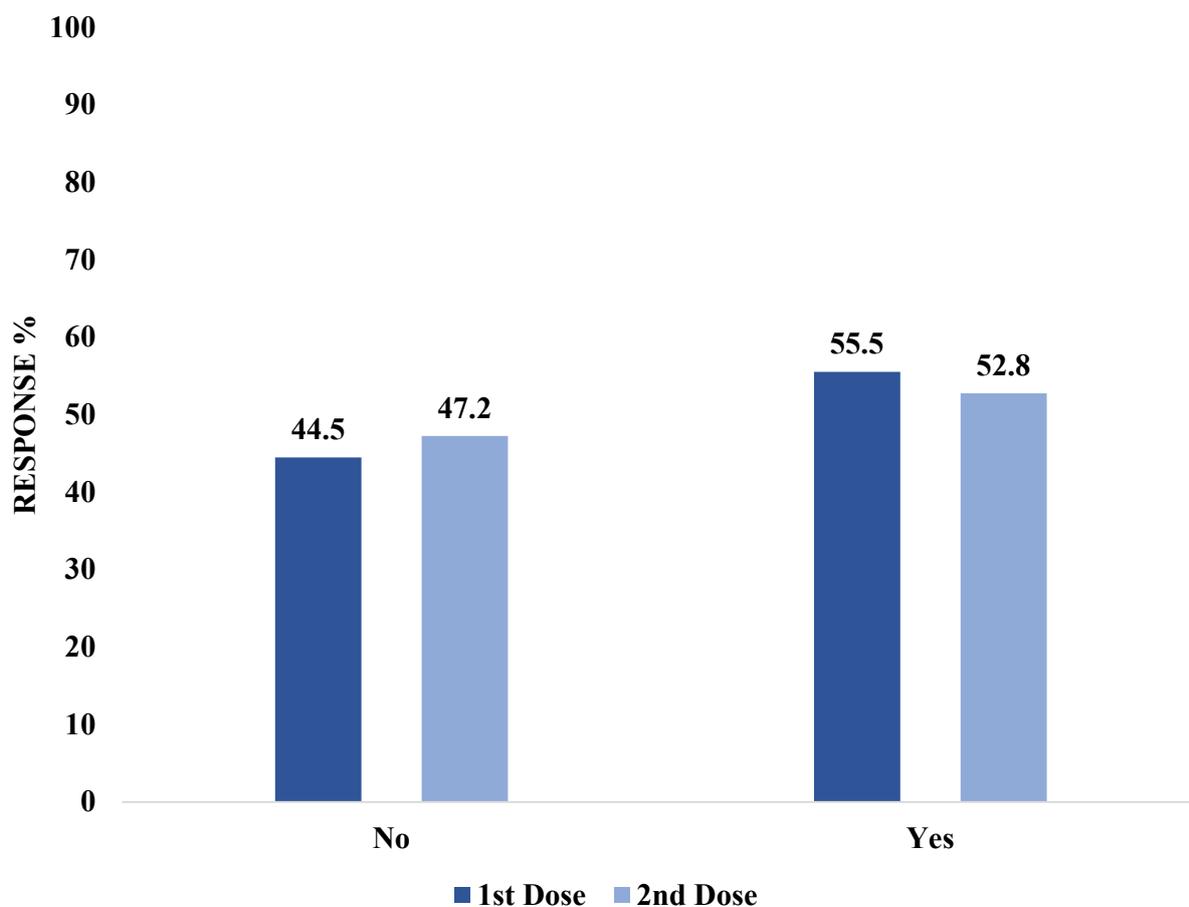


Figure 2. Percentages of reported side effects after receiving the first and second vaccine among the study participants (n= 861).

Table 2. Comparison between the reported side effects by the study participants after the first and second doses of the COVID-19 vaccine.

Side effects	n %				P-value*
	First dose		Second dose		
Pain at the injection site	407	85.1	119	30.4	0.01
Swelling at the injection site	156	32.6	94	24	0.031
Redness at the injection site	118	24.7	236	60.4	0.012
Feeling uncomfortable	329	68.8	324	82.9	0.981
Fatigue	412	86.2	123	31.5	0.011
Flu-like symptoms	164	34.3	144	36.8	0.712
Fever	221	46.2	310	79.3	0.699
Lethargy in the body	409	85.6	156	39.9	0.012
Chills	226	47.3	220	56.3	0.992
Headache	280	58.6	63	16.1	0.028
Shortness of breath	86	18	25	6.4	0.071
Cough	43	9	225	57.5	0.002
Pain in muscles or joints	297	62.1	75	19.2	0.003
GIT Symptoms (such as: nausea - vomiting - diarrhea)	101	21.1	39	10	0.044
Sore throat	57	11.9	33	8.4	0.812

Eye pain	46	9.6	54	13.8	0.618
Stuffy or runny nose	66	13.8	16	4.1	0.061
Loss or change in the sense of taste or smell	31	6.5	49	12.5	0.512
Anorexia	76	15.9	61	15.6	0.873
Chest pain	89	18.6	212	54.2	0.041
Drowsy	298	62.3	96	24.6	0.042
Hair loss	121	25.3	64	16.4	0.127
Heart palpitations or tachycardia	88	18.4	27	6.9	0.622
Lymph node enlargement	33	6.9	27	6.9	0.816
§ Mean score of symptoms ± STD	8.7 ± 4.4		8.1 ± 4.4		0.971

* Significance measure at p-value <0.05 is presented in bold using paired T-test analysis. § Score of symptoms was calculated according to the presence (given 1 point) or absence (given 0 point).

Table 3. Point-biserial correlation between the score of symptoms after the first and second dose of vaccine and the dichotomous demographic variables.

Variables	First Dose-Score of symptoms		Second dose-Score of symptoms	
	Pearson Correlation	P-value*	Pearson Correlation	P-value*
Age	0.018	0.695	0.026	0.608
<30 VS. >30				
Marital status	0.046	0.311	0.044	0.383
Unmarried VS. married				
Residential area	0.095	0.037	-0.04	0.435
Living in Capital VS. noncapital				
Educational level	0.016	0.724	0.075	0.136
University degree VS. non-university degree				
Employment status	-0.082	0.073	0.102	0.044
Employed VS. non-employed				
Smoking status	-0.051	0.268	-0.047	0.354
Smoker VS. non-smoker				
Having chronic diseases	-0.02	0.666	0.047	0.356
Yes VS. No				
Infected with COVID-19	-0.067	0.141	-0.012	0.812
Yes VS. No				
Type of vaccine:	-0.061	0.183	-0.024	0.637
RNA vaccine VS. others				

*Significance measure at p-value <0.05 is presented in bold using Point-biserial correlation

prevalence of side effects, and variations between both doses of the COVID-19 vaccine. Males and females, generally, have different reactions to vaccination. This is reported in many studies where females are more likely to experience side effects after receiving the COVID-19 vaccine.^{13,14} The variation in response may be attributed to several factors such as biological factors (e.g., hormones and genes), variation in how the body processes medications (pharmacokinetics), and the effect of the medications (pharmacodynamics).¹⁵

The study participants mainly consisted of young adults with high education employment rates. These demographic characteristics align with the overall trends observed in

COVID-19 vaccination uptake, where younger and,¹⁶ educated persons¹⁷, maybe more active in seeking vaccination due to higher awareness and access to information.¹⁸ A high proportion of the study participants were non-smokers and did not have any chronic diseases. While this reflects a relatively healthy cohort, it may limit the generalizability of the study's findings to other populations with different health profiles. The prevalence of side effects after the second dose was 55.5%, and changed to 52.8% after the second dose. However, the opposite trend was observed in other studies. For example, a cross-sectional study was conducted, in Poland, among people vaccinated with different types of vaccine; those vaccinated



with Pfizer reported post-vaccinal reactions after the second dose, as 54.8% had more adverse reactions from the vaccine.¹⁹ Similarly, another study conducted among Japanese healthcare workers reported that the frequency and intensity of adverse reactions were more significant after the second dose of the vaccine compared to the first dose.²⁰ Two studies conducted in Saudi Arabia, a neighboring country, revealed that vaccinated people reported more side effects after the second dose of the COVID-19 vaccine.^{13,14} These opposite results suggest the need for further studies to better understand the factors influencing post-vaccination side effects across different populations.

The most reported side effect among the females was pain at the injection site, followed by fatigue and lethargy. The previous findings align with known side effects of COVID-19 vaccines, are anticipated as part of the body's immune response, and are consistent with several studies; Saeed et al., Elgendy et al., and Rabail et al.,²¹⁻²³. It also goes in line with the side effects stated by the United States Centers for Disease Control and Prevention (CDC).²⁴ A recent systematic review was conducted to evaluate the side effects of mRNA-based COVID-19 vaccines. Among the total number of participants (n=10,632), and across 14 included articles reviewed (107 screened), the most reported side effects were injection site pain (77.3%), fatigue (43.0%), muscle pain (39.7%), local swelling (33.6%), and headache (33.3%). These findings are consistent with those of the current study.²⁵

Across several studies, injection site pain constantly ranks as the most reported side effect of the COVID-19 vaccine. This is likely due to many factors such as the injection technique, speed, and the temperature of the vaccine; however, these factors may be difficult to control.²⁶ Simple measures such as lowering the individual's arm while receiving the vaccine injection and providing training on injection techniques to healthcare professionals are likely to reduce injection site pain.²⁷

Interestingly, the second dose of the COVID-19 vaccine triggered a significant rise in some side effects, such as redness at the injection site, cough, and chest pain; the stronger immune reaction can explain this. Furthermore, participants may have been more aware and vigilant about reporting the side effects after experiencing the first dose. Conversely, other side effects, such as pain at the injection site, swelling, and fatigue, were more common after the first dose. This variability highlights the importance of monitoring side effects after each dose. Such monitoring offers a comprehensive understanding of the broad spectrum of vaccine responses.^{28,29}

The point-biserial correlation between the score of symptoms after the first and second doses of the COVID-19 vaccine revealed that residential area was significantly associated with side effects after the first dose (p-value= 0.037). The higher symptom scores among females of non-capital regions could be due to several factors, such as discrepancies in access

to healthcare, variations in reporting behaviors, as well as different socioeconomic factors.³⁰ Clouston et al. published a narrative on the spread patterns of COVID-19 and highlighted that those with lower socioeconomic status are more likely to experience a greater incidence and higher mortality rates associated with COVID-19.³¹ Employment status emerged as a significant variable for the second dose associated with the symptom scores (p-value= 0.044). The significant association with employment status after the second dose might be linked to work stress or occupational exposure, which could impact the severity of the body's response and, thus, the perception of side effects.³²

While being a smoker did not significantly impact the score of symptoms after the first and second doses of the COVID-19 vaccine, it is worth noting that smoking may affect the individuals' immune responses. Smokers tend to have altered immune function and are at higher risk for respiratory infections,³³ which may result in a different vaccine response. However, the current study's findings did not reveal significant differences in side effects scores based on the females' smoking status. Future research could explore how smoking status might change vaccine-induced side effects in a wider range of populations.

The study's findings provide valuable insight into public health strategies in Jordan. Although generally mild and expected, the high prevalence of side effects underscores the importance of clear communication and support for individuals experiencing symptoms after receiving vaccines. Informing the public that these side effects are normal can reduce vaccine hesitancy and build public confidence in vaccination programs. The study's strengths include its relatively large sample size, providing valuable insights. However, limitations such as self-reporting of the side effects should be acknowledged.

CONCLUSION

In conclusion, the present study provides insights into the prevalence of the side effects experienced by Jordanian females after receiving the COVID-19 vaccine. The study's findings emphasize the need for tailored communication strategies to address public worries.

AUTHOR CONTRIBUTIONS

All authors were involved in all parts of the study and manuscript preparation including literature, search, study design, analysis of data, manuscript preparation, and review of the manuscript.

CONFLICTS OF INTEREST

The authors declare no relevant conflicts of interest or financial relationships



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