

# Evaluation of the Different Factors Associated with Side Effects of Covid-19 Vaccination on Medical Students, Mutah University, Al-karak, Jordan

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## Abstract

**Background:** Following the spread of COVID-19 infection, FDA granted emergency authorization and approval of vaccines to protect people from the ensuing pandemic. Adverse effects of the vaccination have not been fully recorded. That is why reporting side effects and conducting specific measures regarding the side effects is crucial.

**Objective:** The aim of the present study is to document vaccine side effects, if recorded, associated with the different types of COVID-19 vaccines among medical students at Mutah University in Jordan.

**Method:** Prospective survey study that was started on January 4th, 2022 till 20th of March, 2022. It was conducted on medical students at Mutah University in Jordan. Statistical analysis was done using SPSS version 25.

**Results:** The results of the present study showed that the most common adverse effect encountered proved to be pain at the site of injection. Tiredness, muscle pain, headache, chills, redness, and swelling at the site of injection were also highly reported. Participants that were infected with COVID-19 before the vaccination reported more side effects than the ones who were infected with the virus after the vaccination. Vaccine recipients who were females or those with lower BMI had higher incidence of COVID-19 vaccine side effects.

**Conclusion:** To conclude, we found that COVID-19 vaccine recipients experienced side effects including muscle pain, chills, dizziness and tiredness. Higher reactivity to the vaccine was associated with prior COVID-19 infection, female gender, lower BMI.

**Keywords:** COVID-19; muscle pain; dizziness and tiredness; lower BMI

## Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is a virus that belongs to the human coronavirus family and is also known as coronavirus disease (COVID-19). COVID-19 was discovered during the outbreak of the highly transmissible respiratory disease in Wuhan, China, in 2019 and has emerged as a significant public health concern (Phelan et al., 2020). The virus spread rapidly among many countries resulting in a

necessity for preventive measures such as social distancing, hand hygiene, travel restrictions, and countrywide lockdowns (Mathieu et al., 2021)

Combined with non-pharmaceutical interventions, vaccination was the best way to control the pandemic. The first COVID-19 vaccine doses were given to humans in March 2020 (Tregoning et al., 2021) and vaccine regimens were created to provide COVID-19 vaccines at multiple intervals (first, second, and booster) to increase efficacy. Similarly,

Jordan implanted all the protective protocols and measures to decrease the transmission rate, receiving its first COVID-19 vaccine shipment by March 13, 2021, of AstraZeneca/SK Bioscience (World Health Organization, 2021) and others like Bio NTech, Pfizer vaccine, and Sinopharm BBIBP vaccine. The health ministry prioritized vaccine distribution starting with high-risk groups, followed by a mass vaccination campaign targeting all strata of society. Notable side effects have been reported post-COVID-19 vaccinations. Commonly reported symptoms included soreness, muscle pain, headache, chills, itching, redness/swelling at the injection site, joint pain, flushing, dizziness, and fever. At the same time, allergic reaction myocarditis, palpitations and vaccine-induced immune thrombotic thrombocytopenia were also reported at a lower rate (Saeed et al., 2021; Beatty et al., 2021; Kadali et al., 2021).

This study aims to examine the side effects associated with the different doses of COVID-19 vaccine in Al Karak, Jordan. While many review studies have compared the different side effects of each type of vaccine, few studies were found evaluating the association with the number of doses and other factors that could contribute to varying side effects.

## Methodology

### Study design and population:

For this cross-sectional research study, an online survey was distributed to medical students at Mutah University, School of Medicine. The study participants were medical students from both primary and clinical years (first up to sixth year) including males and females from all nationalities. We used a simple random sampling method for selecting the target sample. The privacy of data was maintained.

### Questionnaire

The survey was administered through an online Google form. The language used was English with some parts translated to Arabic. The

questionnaire consisted of six main sections with 32 questions. The first section asked about the participants' demographic characteristics including age, gender, weight, and height. The second, third, and fourth sections questioned about the first dose of COVID-19 vaccine, the second dose of COVID-19 vaccine, and the third or booster dose of COVID-19 vaccine, respectively. In these sections, the survey asked about the vaccine type, place of vaccination, side effects on the site of injection, and other side effects of the vaccine. The fifth and sixth sections contained questions regarding COVID-19 infection and its relationship with the vaccine. The questions were guided by medical information from the National Health Service (NHS) and Centers for Disease Control and Prevention (CDC).

### Data collection:

IRB was obtained from Mutah School of Medicine Ethical Committee, and data collection took place from January 4th, 2022 till 20th of march. The online questionnaire was distributed through medical social media groups (Facebook, WhatsApp, Twitter, and Telegram). We calculated the sample size using Check Market online software with a margin of error= 5%, confidence interval= 95%, and response distribution= 50%; thus, the recommended sample size was 394 medical students in Mutah University.

### Statistical analysis

IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA) was used for statistical analysis.

## Results

### Population characteristics

The sample size of the study consisted of 394 students. The female participants (60.9%) were more than the male participants (39.1%). Most of the participants were 1<sup>st</sup> year medical students, followed by fourth year medical students (23.2%). The age of the participants ranged between 17 and 24.

<b>Sample size</b>	<b>394 participants out of 2519 students (15.7%)</b>	
<b>Gender</b>	Male 155 participants (39.1%) Female 241 participants (60.9%)	
<b>Medical year</b>	1st	62.6%
	2nd	4.8%
	3rd	4.0%
	4th	23.2%
	5th	2.5%
	6th	2.8%

**Table 1:** Participant Characteristics

### Vaccine type:

As shown in Table 2, most of the participants from all regions took the Pfizer vaccine (middle 65%, south 64%, north 66.7% other regions

43,3%), followed by Sinopharm. While most of participants who took oxford were from the north. (p value< 0.001).

Vaccine type/ place	Middle of Jordan	South of Jordan	North of Jordan	Outside Jordan
<b>Pfizer</b>	91 (65.9%)	100 (64.5%)	28 (66.7%)	13 (43.3%)
<b>Sinopharm</b>	44 (31.9%)	48 (31.0%)	9 (21.4%)	14 (46.7%)
<b>Oxford</b>	1 (0.7%)	7 (4.5%)	5 (11.9%)	3 (10.0%)
<b>Other</b>	2 (1.4%)	0	0	0
<b>Not vaccinated</b>	0	0	0	0

**Table 2:** Vaccine Type

### Side Effects Related to Vaccine Dose

Figure 1 shows that the most common side effect in the three doses was pain on the site of infection, and it appeared to be even more prevalent in

the booster dose (80%). Next followed tiredness, muscle pain, and headache. The least common side effect was DVT. Most of the side effects were more common in the first dose, while DVT and seizure were more common in booster dose.

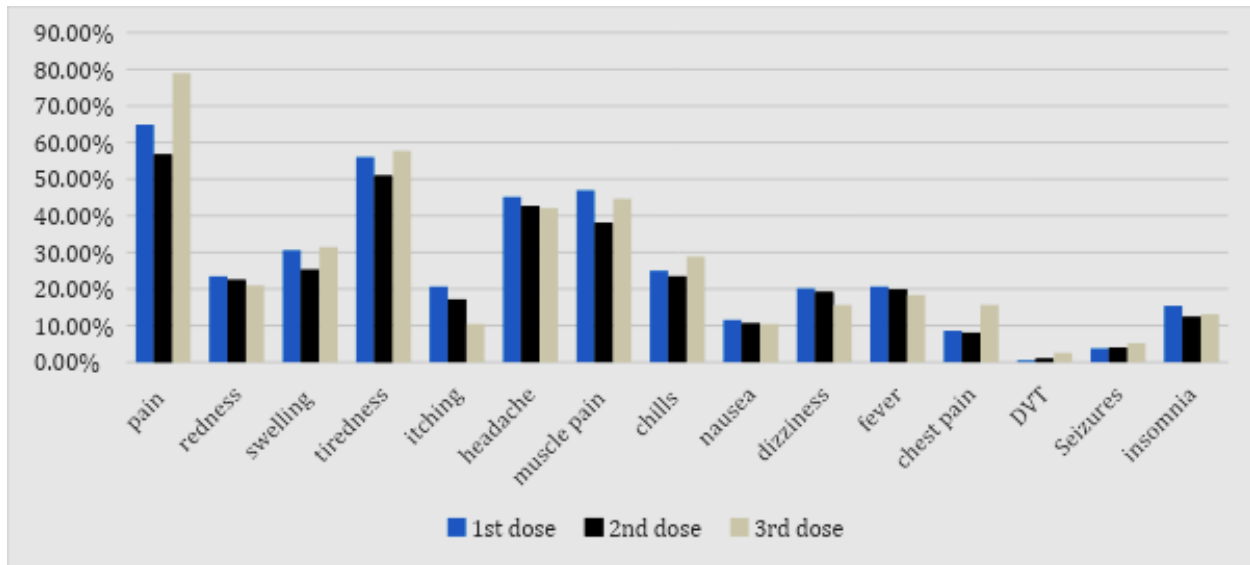


Figure 1: Side effects related to vaccine dose

Side Effects Related to Vaccine Type

The participants that received Pfizer vaccine show high incidence of COVID-19 related side effects (p value<0.001).

Side effect of first dose / place	Vaccine type	Middle	South	North	Out Jordan
Yes, have side effect	Pfizer	29 (90.6%)	33 (84.6%)	6 (60%)	0
	Sinopharm	2 (6.3%)	4 (10.3%)	3 (30%)	1 (100%)
	Oxford	0	2 (5.1%)	1 (10%)	0
	Other	1 (3.1%)	0	0	0
No, have not	Pfizer	62 (58.5%)	67 (57.8%)	22 (68.8%)	13 (44.8%)
	Sinopharm	42 (39.6%)	44 (37.9%)	6 (18.8%)	13 (44.8%)
	Oxford	1 (0.9%)	5 (4.3%)	4 (12.5%)	3 (10.3%)
	Other	1 (0.9%)	0	0	0

Table 3: Side effects related to vaccine type

Side Effects Related to Covid-19 Infection

As seen in Figure 2, participants who were infected with covid-19 after the booster dose had the highest incidence of side effects. Those who were infected before getting vaccinated also had relatively high incidence of side effects.

Additionally, results of this study show that female participants reported a higher incidence of booster dose side effect than male participants did (p value< 0.03)

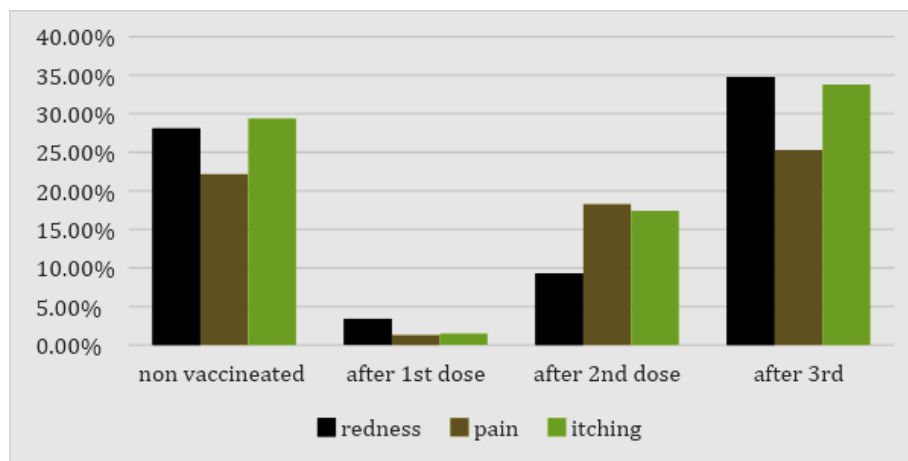
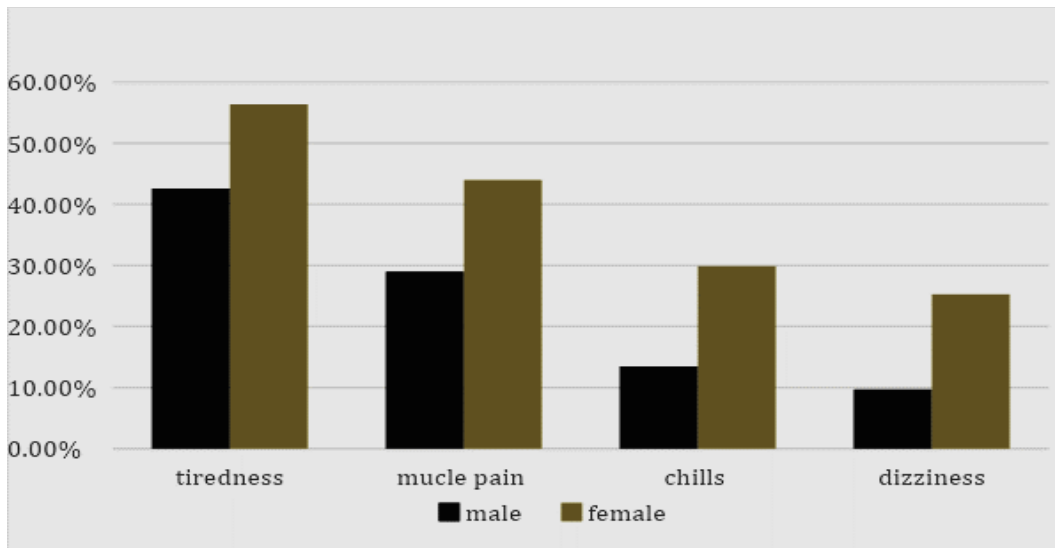


Figure 2: Side effects related to COVID-19 infection

**Side Effects Related to Gender**

Results show that symptoms of tiredness, muscle pain, chills, dizziness, and nausea were more common in females than in males in second dose (p value < 0.05).

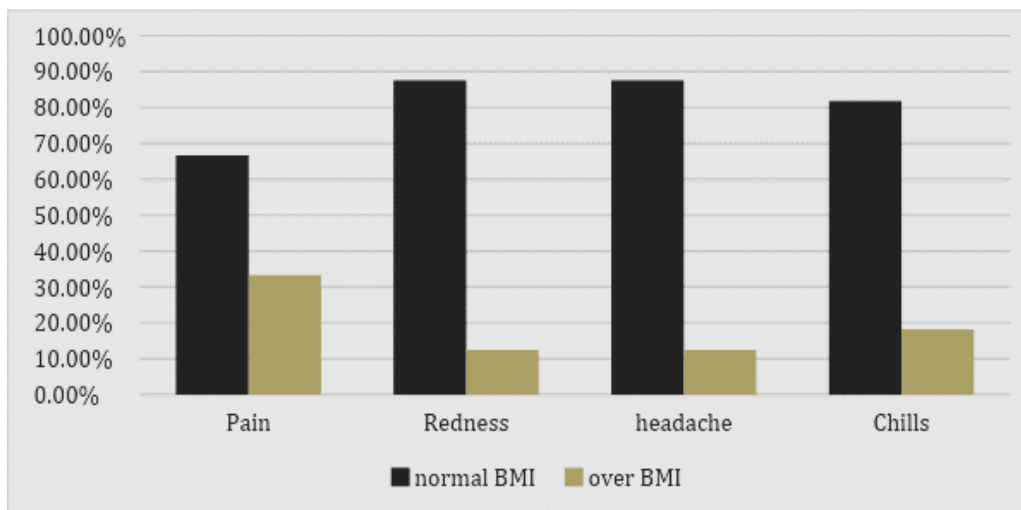


**Figure 3: Side effects related to gender**

**Side Effects Related to Bmi**

38 participants from 396 (9.6%) took the booster dose. Participants of normal weight experienced more side effects (pain, redness, tiredness,

headache, and chills) than participants who were overweight or had high BMI (p value < .03).



**Figure 4: Side effects related to BMI**

**Discussion**

This study aimed to collect and analyze the most common post-vaccination adverse effects after each dose among a population of medical students at Mut'ah University in Al-Karak, Jordan. Additionally, other factors associated with increased reactogenicity to the COVID-19 vaccine have been reported and discussed further.

Our results revealed that participants who had taken the COVID-19 vaccine had experienced side effects including fatigue, pain at the site of injection, muscle pain, chills, and dizziness. The various types of COVID-19 vaccines that are used in Jordan are relatively safe with no reported anaphylaxis or serious complications. Nonetheless, a higher incidence of

the side effects was associated with Pfizer vaccine. The most common reported side effects were pain at the site of injection, tiredness, muscle pain, and headache. Other symptoms that were also reported were swelling, redness, and itching at the site of injection. However, there was an obvious increase in the percentage of individuals suffering from local symptoms after the booster (third) dose of the vaccine, as Figure 1 shows that pain on the site of injection was more prevalent after the third dose. This finding is surprisingly inconsistent with another study done to evaluate the prevalence of side effects of booster dose in Saudi Arabia. Outcomes of the Saudi study portrayed that pain at the site of injection along with fatigue is among the least reported side effects in post booster dose (Ali wt al., 2022).

In addition, it was found that participants that were infected with COVID-19 before the vaccination had more side effects than the ones who were infected with the virus after the vaccination. A prospective study done in a university tertiary care hospital in Besançon, France showed similar findings in which it was revealed that vaccine recipients with prior COVID-19 infection reported more side effects (Tissot et al., 2021). This is most likely because vaccines have increased immunogenicity and higher antibody titers in individuals with past infection (Menni et al., 2021).

Moreover, the results of the present study documented that females were more commonly affected by the inflammatory and immune response to vaccines. Side effects in women proved to be more prominent and their incidence was higher. These findings are similar to the findings of a study that was conducted in the University of Florida which also showed that females were more commonly affected than males (Bartley & Fillingim, 2013). Behavioral, genetic, and hormonal elements could be possible triggers to the divergence in adverse events after vaccination in both genders (Vassallo et al., 2021). The specific underlying mechanisms contributing to this disparity is unknown, however, many theories explained that difference in genetic factors and endogenous opioids between the sexes may be a reason for the variation. Also, some studies showed that sensitivity to pain varies with different sex hormones<sup>11</sup>. For instance, one study revealed that estrogen plays a role in stimulating an immune response while testosterone does the opposite. Additionally, many immune-related genes are strongly associated with the X chromosome of which females have two copies while males have only one (Al-Qazaz et al., 2022).

Furthermore, results of present study shed light on the relation between the body mass index and post COVID-19 vaccination effects. Vaccine recipients with normal body mass index experienced more side effects than individuals with high body mass index. In agreement with our results, the Iguacel et al.'s (2021) study in Spain who reported that BMI that is above 25 cc was related to lower side effects and that non-overweight participants experienced significantly more side effects than overweight subjects<sup>14</sup>. Similarly, another study by Ebrahimian et al. (2022) came up with parallel conclusions<sup>15</sup>. Overall, the relationship between side effects experienced with COVID-19 vaccine and weight status can be best justified by the concentration of antibody titers (Iguacel et al., 2021). Many studies suggested that central obesity is among the elements associated with low levels of antibody titers in response to COVID-19 vaccine (Watanabe et al., 2022). This in fact would explain the low adverse effects individuals with high body mass index experience after receiving COVID-19 vaccine.

## Conclusion

To conclude, we found that COVID-19 vaccine recipients experienced side effects including pain at the site of injection, tiredness, muscle pain, and headache. Higher reactogenicity to the vaccine was associated with prior COVID-19 infection, female gender, lower BMI, accompanied with no further serious side effects. For statistical comparisons, the percentage is used rather than the original number. As a result, when we compare males and females, we compare the percentage that appeared in females and the percentage that appeared in males, as well as location of residence and other factors. So, it is advisable to encourage whole society to be vaccinated against covid-19 with any available type of vaccine for better protection.

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