ORIGINAL ARTICLE

Adverse Effects of Corona Virus Disease 2019 Vaccines among Zagazig University Personnel

Niveen E Zayed [1], Ashraf El Sayed El Shora[1], Amr Ali Abd Allah Elmaghraby [1*], Mohammad Walaa [1]

(1) Chest Department, Faculty of Medicine, Zagazig University, Egypt

Corresponding author:
Amr Ali Abd Allah Elmaghraby

Email:
amr.ali17894@gmail.com

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ABSTRACT

Background: The incidence of adverse events following the administration of COVID-19 vaccination was significantly related to the total number of doses administered. This study aimed to assess the association between COVID-19 vaccines and the risk of adverse effects occurrence among Zagazig University Personnel.

Methods: This cross-sectional retrospective study included 1041 participants, who have taken 1 or more of COVID-19 doses. They were divided into those who had taken either Pfizer, AstraZeneca, Sinopharm, Sinovac, Moderna, Johnson, or Sputnik vaccine. Data were collected from using a designated questionnaire. The frequency of the adverse reactions was estimated.

Results: There is a significant difference between vaccine type and adverse effects of different vaccines (like local pain, fever, headache, myalgia, and chills) among the studied group who received the first dose, 2nd dose, or 3rd doses of vaccines, also between vaccine type and abdominal adverse effects (nausea, vomiting, diarrhea or abdominal pain), between vaccine type and all of the following respiratory(cough, runny nose, sore throat, dyspnea), cardiac adverse effects (palpitations), abdominal adverse effects of different vaccines among the studied group who received the 1st or 2nd or 3rd doses of different types of vaccines (with a p-value of <0.001 for all significant previous differences). People who received Sinopharm had the highest vaccine with no or minimal side effects followed by Sinovac.

Conclusion: Vaccinations against COVID-19 come with some mild side effects. Safest vaccine was Sinovac, dangerous side effects as dyspnea and chest pain were associated with Pfizer vaccine while the vaccine accompanied by many side effects was AstraZeneca.

Keywords: Corona Virus Disease 2019, Vaccines, side effects, Zagazig University.

INTRODUCTION

The worldwide economy, global public health infrastructure, and social behaviors have all been negatively impacted by the COVID-19 pandemic. Vaccines are still the most effective way to fight COVID-19, even with the introduction of isolation and symptomatic and monoclonal antibody treatment [1]. By stimulating the immune system to create antibodies, vaccines may protect patients from being infected with coronavirus or experiencing severe symptoms. Vaccination results in the production of antibodies, which bind to the invading spike protein and block viral entry into cells. That's why government organizations, academic institutions, and pharmaceutical firms are all in a mad dash to develop and commercialize safe and effective vaccinations [2]. Vaccines are a crucial part of any infection control strategy. More than 135 vaccinations have been implemented and tested on humans by the year 2021. Pfizer-BioNTech and Moderna's mRNA vaccines, AstraZeneca and Johnson's recombinant adenovirus

vectored vaccines, and SinoPharma and SinoVac's inactivated vaccines have all been the most rapid produced ones [3]. There was a strong association between the total number of COVID-19 vaccine doses given and the number of reported adverse events. Most serious adverse reactions occur after the first dose. The Centers for Disease Control and Prevention (CDC) reports that more severe side effects may develop after the second dose. Although adverse effects from all COVID-19 vaccines are similar, the intensity and frequency of these symptoms vary greatly each vaccine [4]. Vaccine side effects are divided into two categories, mild to Modernate, and severe. Severe adverse effects include cardiac adverse effects: acute myocardial infarction, myocarditis, arrhythmias and cerebral sinus venous thrombosis, splanchnic vein thrombosis, deep vein thrombosis, arterial thrombosis, pulmonary embolism, are all possible complications of vaccine-induced immune thrombotic thrombocytopenia (VITT) [5-8]. Therefore, we did this work to assess the association between COVID-19 vaccines and the risk of adverse effects occurrence among Zagazig University Personnel.

SUBJECTS AND METHODS

This cross-sectional retrospective study was done at Zagazig University during the period from November 2022 to April 2023. This study included 1041 participants. There were 493 males and 548 females with an age range from 18 to 66 years.

Inclusion criteria: Vaccinated persons (Staff members, employees, workers, students, physicians, nurses) who had taken one dose or more who were 18 years or older.

Exclusion Criteria: Persons with past history of severe allergic reaction (acute anaphylactic shock, angioneurotic edema or laryngeal edema) to any vaccine other than COVID-19 Vaccine.

After institutional review board approval of IRB (#9700/6-9-2022), written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

The included individuals were divided into specific groups: those who had taken either Sinopharm, Sinovac, AstraZeneca, Pfizer, Moderna, Johnson, or Sputnik vaccine. Data were collected from the participants using a designated questionnaire (Table S1). Information such as participants' demographics was gathered via questionnaire (sex, age, work, as well as smoking); comorbidities (diseases of the heart, lungs, kidneys, liver, immune system, cancer, obesity as well as endocrine disorders), if the participant had COVID-19 infection before or after vaccination or not and how long before or after, type and the number of vaccine doses; duration between each other, and the symptoms that people had after the vaccination, after which dose did these symptoms happen, the duration of these symptoms and how the participant acts to relieve these symptoms and if participants advice other to get vaccinated or not. It was determined by analyzing and assessing the frequency of these adverse responses which symptoms are more common and which vaccine could be associated with them.

Statistical analysis

All data was analyzed statistically with SPSS 26.0 for Windows (SPSS Inc., Chicago, IL, USA). Results were shown in both numerical (mean ± SD) and qualitative (absolute (number) and relative (frequency)) formats (percentage). Percentage differences between categorical variables were compared using Chi-square tests or Fisher's exact tests.

RESULTS

Regarding the demographic data of participants: It was found that (60.4%) of participants were younger than 40 years of age, and (39.6%) were 40 years or older. More than half of cases (52.6%) were female, and (47.4%) were male. Both employees and Staff members represent equal percent (25.6%), about (22.8%) were physicians, (16.4%) were Nurses/ Mrs., and (9.6%) were workers. Most participants (68.6%) were non-smoker, (27.2%) were smokers and (4, 2%) were ex-smoker. All study participants had received their first COVID-19 vaccine dose, while (87.5%) had received both doses, and only (5.5%) completed the three doses because only the 1st and 2nd doses were the compulsory doses and the 3rd dose were optional. Of the participants, (49%) individuals received the Sinovac vaccine, followed by (18.3%) received AstraZeneca, about (10.6%) people received Sinopharm, and 7.7%, 5.8%, 4.9%, 3.8% respectively received Pfizer, Moderna, Sputnik, and Johnson (Table 1).

There is significant difference between vaccine type and adverse effects of different vaccines among the studied group who received the first dose of vaccines, people who received AstraZeneca showed higher reports of local pain (92.1%), myalgia

(72.1%), arthralgia (53.2%), fatigue (57.9%), skin rash (5.3%), dizziness (14.2%), numbness (13.2%) and tremors (14.2%). People who received Moderna showed higher reports of myalgia (51.7%), headache (58.3%), and chills (40%). Johnson vaccine recorded higher reports of fever (42.5%), headache (57.5%) and chills (27.5%). Sinovac vaccine was the highest vaccine with no side effects (14.9%) (Table 2). There is a significant difference between vaccine type and abdominal adverse effects of different vaccines among the studied group who received the first dose of vaccines, People who received AstraZeneca showed higher reports of abdominal pain (13.2%), and people who received Moderna showed higher reports of nausea &vomiting (23.3%) and diarrhea (6.7%) (Table 3). There is a significant difference between vaccine type and respiratory and cardiac adverse effects of different vaccines among the studied group who received the first dose of vaccines, people who received AstraZeneca showed higher reports of Cough (5.3%), sore throat (5.3%), people who received Sinopharm showed higher reports of runny nose (10%) followed by Pfizer vaccine (8.8%). People who received Sputnik showed higher reports of palpitation (13.7%) followed by the Moderna vaccine (11.7%). Chest pain and dyspnea appeared only with the Pfizer vaccine in (2.5%) of cases (Table 4). There is a significant difference between vaccine type and adverse side effects of different vaccines among the studied group who had received the second dose only or completed the third dose of vaccine, people who received AstraZeneca showed higher reports of fever (33.2%) followed by Pfizer

(29.3%), also showed higher reports of myalgia (56%), and arthralgia (33.2%). Pfizer showed higher reports of local pain (89.3%) followed by AstraZeneca (84.8%). People who received Moderna showed higher reports of headache (50%), chills (25.9%), skin rash (12.1%) and dizziness (6.9%). Sinopharm vaccine was the highest vaccine with no side effects (52.3%) followed by Sinovac (37%) (Table 5). There is a significant difference between vaccine type and abdominal adverse side effects of different vaccines among the studied group who had received the second and third doses of vaccine, People who received AstraZeneca showed higher reports of abdominal pain (5.4%), and only people who received Sputnik showed reports of diarrhea (2%) (Table 6). There is a significant difference between the type of vaccine and respiratory and cardiac adverse side effects of different vaccines among the studied group who had received the second and third doses of vaccines, people who received Sinopharm showed higher reports of sore throat (5.6%), and runny nose (8.4%) followed by Pfizer vaccine (8%). Also, people who received the Moderna vaccine showed higher reports of palpitation (6.9%) followed by Sputnik (6.1%). Chest pain and dyspnea appeared only with Moderna vaccine in (1.7%) of cases (Table 7). There is significant difference between adverse effects after vaccination and both comorbidities and history of COVID 19 infection before vaccination. (98.6%) of cases with comorbidities and (95.1%) of cases with positive history of COVID 19 infection showed adverse effects (Table S2).

Table (1): Basic characteristic of the studied group (n=1041).

Study group (n=1041)			
Category		**No.**	**%**
Age	18-25	185	17.8
	26-39	444	42.7
	≥40	412	39.6
Gender	Male	493	47.4
	Female	548	52.6
Occupation	Employee	266	25.6
	Worker	100	9.6
	Staff member	267	25.6
	Nurse/ mrs	171	16.4
	Physician	237	22.8
Smoking	Smoker	283	27.2
	Non smoker	714	68.6

		Ex-smoker	44	4.2
Allergy		Yes	43	4.1
Comorbidities		Hypertension	193	18.5
		Diabetes	137	13.2
		Cardiac disorder	29	2.8
		Kidney disorder	3	0.3
		Respiratory disorder	71	6.8
		Thyroid disorder	37	3.6
		Cancer	7	0.7
		Autoimmune diseases	12	1.2
		Obesity	20	1.9
		No	735	70.6

Table (2): Comparing frequency distribution of adverse effects of different vaccines among the studied group who received the first dose of vaccines (n=1041).

Variables		Vaccine type							Test	
Side effects		**Sinovac (n=510)**	**AstraZeneca (n=190)**	**Sinopharm (n=110)**	**Pfizer (n=80)**	**Moderna (n=60)**	**Johnson (n=40)**	**Sputnik (n=51)**	**Test X^2**	**P value**
Local pain	N	286	175	59	71	55	22	19	144.55	**<0.001***
	%	56.1%	92.1%	53.6%	88.8%	91.7%	55.0%	37.3%		
Fever	N	92	74	10	5	23	17	19	81.32	**<0.001***
	%	18.0%	38.9%	9.1%	6.3%	38.3%	42.5%	37.3%		
myalgia	N	91	137	13	18	31	10	23	230.26	**<0.001***
	%	17.8%	72.1%	11.8%	22.5%	51.7%	25.0%	45.1%		
headache	N	173	78	18	9	35	23	10	68.79	**<0.001***
	%	33.9%	41.1%	16.4%	11.3%	58.3%	57.5%	19.6%		
Arthralgia	N	82	101	12	18	16	8	0	137.30	**<0.001***
	%	16.1%	53.2%	10.9%	22.5%	26.7%	20.0%	0.0%		
Fatigue	N	263	110	48	42	38	10	15	30.02	**<0.001***
	%	51.6%	57.9%	43.6%	52.5%	63.3%	25.0%	29.4%		
Chills	N	37	0	0	0	24	11	13	50.71	**<0.001***
	%	7.3%	0.0%	0.0%	0.0%	40.0%	27.5%	25.5%		
skin rash	N	21	10	4	4	11	2	0	26.46	**<0.001***
	%	4.1%	5.3%	3.6%	5.0%	18.3%	5.0%	0.0%		
Dizziness	N	32	27	6	3	8	3	3	17.82	**0.007***
	%	6.3%	14.2%	5.5%	3.8%	13.3%	7.5%	5.9%		
Numbness	N	7	25	4	0	1	0	0	65.13	**<0.001***
	%	1.4%	13.2%	3.6%	0.0%	1.7%	0.0%	0.0%		
Tremors	N	0	27	0	3	1	0	0	105.32	**<0.001***
	%	0.0%	14.2%	0.0%	3.8%	1.7%	0.0%	0.0%		
no side effects	N	76	10	24	6	5	4	1	106.48	**<0.001***
	%	14.9%	5.3%	21.8%	7.5%	8.3%	10.0%	2.0%		

(X^2) =Chi-Square Tests

Table (3): Comparing frequency distribution of abdominal adverse effects of different vaccines among the studied group who received the first dose of vaccines (n=1041).

Variables		Vaccine type							Test	
Side effects		Sinovac (n=510)	AstraZeneca (n=190)	Sinopharm (n=110)	Pfizer (n=80)	Modera (n=60)	Johnson (n=40)	Sputnik (n=51)	Test X^2	P value
Nausea &vomiting	N	26	19	0	0	14	5	2	50.71	**<0.001***
	%	5.1%	10.0%	0.0%	0.0%	23.3%	12.5%	3.9%		
Diarrhea	N	0	6	0	0	4	0	2	34.775	**<0.001***
	%	0.0%	3.2%	0.0%	0.0%	6.7%	0.0%	3.9%		
abdominal pain	N	23	25	0	0	2	0	1	41.090	**<0.001***
	%	4.5%	13.2%	0.0%	0.0%	3.3%	0.0%	2.0%		

(X^2) =Chi-Square Tests

Table (4): Comparing frequency distribution of respiratory & cardiac adverse effects of different vaccines among the studied group who received the first dose of vaccines (n=1041).

Variables		Vaccine type							Test	
Side effects		Sinovac (n=510)	AstraZeneca (n=190)	Sinopharm (n=110)	Pfizer (n=80)	Moderna (n=60)	Johnson (n=40)	Sputnik (n=51)	Test X^2	P value
Cough	N	11	10	0	4	2	0	2	11.107	0.085
	%	2.2%	5.3%	0.0%	5.0%	3.3%	0.0%	3.9%		
Sore throat	N	24	10	7	0	3	0	0	9.670	0.139
	%	4.7%	5.3%	6.4%	0.0%	5.0%	0.0%	0.0%		
Runny nose	N	31	10	11	7	1	0	0	12.549	0.051
	%	6.1%	5.3%	10.0%	8.8%	1.7%	0.0%	0.0%		
Dyspnea	N	0	0	0	2	0	0	0	24.071	**0.001***
	%	0.0%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%		
Chest pain	N	0	0	0	2	0	0	0	24.071	**0.001***
	%	0.0%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%		
Palpitation	N	19	15	5	2	7	4	7	18.758	**0.005***
	%	3.7%	7.9%	4.5%	2.5%	11.7%	10.0%	13.7%		

(X^2) =Chi-Square Tests

Table (5): Comparing frequency distribution of adverse effects of different vaccines among the studied group who received the second dose only or complete the third dose of vaccine(n=968).

Variables		Vaccine type						Test	
Side effects		Sinovac (n=495)	AstraZeneca (n=184)	Sinopharm (n=107)	Pfizer (n=75)	Moderna (n=58)	Sputnik (n=49)	Test X^2	P value
Local pain	N	122	156	21	67	49	12	333.76	**<0.001***
	%	24.6%	84.8%	19.6%	89.3%	84.5%	24.5%		
Fever	N	31	61	4	22	13	11	106.41	**<0.001***
	%	6.3%	33.2%	3.7%	29.3%	22.4%	22.4%		
Myalgia	N	51	103	9	16	25	14	187.77	**<0.001***
	%	10.3%	56.0%	8.4%	21.3%	43.1%	28.6%		
Headache	N	97	46	9	4	29	6	56.99	**<0.001***
	%	19.6%	25.0%	8.4%	5.3%	50.0%	12.2%		
Arthralgia	N	36	61	4	19	11	0	103.93	**<0.001***
	%	7.3%	33.2%	3.7%	25.3%	19.0%	0.0%		
Chills	N	21	0	0	0	15	7	90.94	**<0.001***
	%	4.2%	0.0%	0.0%	0.0%	25.9%	14.3%		
Skin rash	N	11	0	2	2	7	0	30.62	**<0.001***
	%	2.2%	0.0%	1.9%	2.7%	12.1%	0.0%		
Dizziness	N	12	10	0	3	4	2	10.29	0.067
	%	2.4%	5.4%	0.0%	4.0%	6.9%	4.1%		
Tremors	N	0	0	2	2	0	0	18.03	**0.003***
	%	0.0%	0.0%	1.9%	2.7%	0.0%	0.0%		
No side effects	N	183	34	56	13	11	2		**<0.001***
	%	37.0%	18.5%	52.3%	17.3%	19.0%	4.1%		

(X^2) =Chi-Square Tests

Table (6): Comparing frequency distribution of abdominal adverse effects of different vaccines among the studied group who received the second dose only or complete the third dose of vaccine(n=968).

Variables		Vaccine type						Test	
Side effects		Sinovac (n=495)	AstraZeneca (n=184)	Sinopharm (n=107)	Pfizer (n=75)	Modera (n=58)	Sputnik (n=49)	Test X^2	P value
Nausea and vomiting	N	5	10	0	0	0	1	21.53	**<0.001***
	%	1.0%	5.4%	0.0%	0.0%	0.0%	2.0%		
Diarrhea	N	0	0	0	0	0	1	18.77	**0.002***
	%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%		
abdominal pain	N	7	0	0	0	0	0	6.74	0.241
	%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%		

(X^2) =Chi-Square Tests

Table (7): Comparing frequency distribution of respiratory & cardiac adverse effects of different vaccines among the studied group who received the second dose only or complete the third dose of vaccine (n=968).

Variables		Vaccine type						Test	
Side effects		Sinovac (n=495)	AstraZeneca (n=184)	Sinopharm (n=107)	Pfizer (n=75)	Moderna (n=58)	Sputnik (n=49)	Test X^2	P value
Cough	N	4	0	0	2	2	1	9.918	0.078
	%	0.8%	0.0%	0.0%	2.7%	3.4%	2.0%		
Sore throat	N	9	0	6	0	2	0	15.68	**0.008***
	%	1.8%	0.0%	5.6%	0.0%	3.4%	0.0%		
Runny nose	N	8	0	9	6	1	0	32.61	**<0.001***
	%	1.6%	0.0%	8.4%	8.0%	1.7%	0.0%		
Dyspnea	N	0	0	0	0	1	0	15.71	**0.008***
	%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%		
Chest pain	N	0	0	0	0	1	0	15.71	**0.008***
	%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%		
Palpitation	N	9	8	2	5	4	3	11.26	**0.047***
	%	1.8%	4.3%	1.9%	6.7%	6.9%	6.1%		

(X^2) =Chi-Square Tests

DISCUSSION

The global burden of disease and mortality has been greatly exacerbated by the 2019 coronavirus disease (COVID-19) pandemic. Since the beginning of the COVID-19 pandemic in December 2019, over 630 million confirmed infections and over 6.58 million linked fatalities have been documented worldwide [9]. People's mobility and social lives have been negatively impacted by this pandemic. Several countries and localities have declared emergencies and instituted

lockdowns to cease the spread of the pandemic, but so far these precautions have only partially succeeded [10]. The development of vaccines for COVID-19 has been one of the most promising interventions towards eradication and control of the pandemic [11, 12].

Our current findings clearly revealed that regarding the demographic data of participants: It was found that (60.4%) participants were younger than 40 years of age, and (39.6%) were 40 years or older. more than half of cases (52.6%) were female, and (47.4%) were male. Both employees and Staff members represent equal percent (25.6%), about (22.8%) were physicians, (16.4%) were Nurses/ Mrs., and (9.6%) were workers. Most participants (68.6%) were non-smoker, (27.2%) were smokers and (4, 2%) were ex-smoker. Regarding chronic diseases, 735 (70.6%) were healthy, while the rest (29.4%) had chronic diseases. The most prevalent chronic conditions were hypertension 18.5% followed by diabetes 13.2%, while, respectively, 6.8%, 3.6%, 2.8%, 1.9%, 1.2%, 0.7%, and 0.3% suffered from chronic respiratory diseases, thyroid disorder, heart disease, obesity, autoimmune diseases cancer, and kidney disease. Our findings were like Le et al. [13], who reported that of the 1,878 participants, 940 (50%) were aged between of 35 and 55, 1,151 (61.3%) were females, 526 (28%) had comorbid diseases, and 332 (17.7%) had a previous infection with COVID-19. Moreover, results of Newman et al. [14] showed that two hundred and ten of the 231 people who were screened ended up being enrolled and randomly assigned to one of four groups receiving various vaccinations; in the Pfizer groups, participants were recruited into two age groups. The median age of the 210 participants was 77.5 years (range: 71.0-84.0 years), and the median body mass index was 24.1 kg/m2 (range: 21.6-26.7 kg/m^2). Most of the participants were females (70.5%). Most of individuals (81.9%) had one health problem at least, their median Charlson Comorbidity Index was 4.0 (3.0–5.0). There is significant difference between the adverse effects and both comorbidities and history of COVID 19 infection before vaccination. (98.6%) of cases with comorbidities and (95.1%) of cases with positive history of COVID 19 infection showed adverse effects. There is significant difference between vaccine type and adverse effects of different vaccines among the studied group who received the first dose of vaccines, people who received

AstraZeneca showed higher reports of local pain (92.1%), myalgia (72.1%), arthralgia (53.2%), fatigue (57.9%), skin rash (5.3%), dizziness (14.2%), numbness (13.2%) and tremors (14.2%). people who received Moderna showed higher reports of myalgia (51.7%), headache (58.3%), chills (40%). Johnson vaccine recorded higher reports of fever (42.5%), headache (57.5%) and chills (27.5%). Sinovac vaccine was the highest vaccine with no side effects (14.9%).

Our findings were consistent with Ramasamy et al. [15], who noted that One or more adverse events were reported by 1 217 (64%) of 1,217 study participants after receiving the COVID-19 vaccine. Discomfort at the injection site (47%), exhaustion and drowsiness (28.2%), and joint/muscle pain (23.1%) were the most common adverse effects reported by those who received the COVID-19 vaccination, followed by headache (17.7%) and fever (5%). (14.4 percent). Number of recorded adverse events varied depending on vaccination type.

Our current findings clearly revealed that there is significant difference between vaccine type and abdominal adverse effects of different vaccines among the studied group who received the first dose of vaccines, people who received AstraZeneca showed higher reports of abdominal pain (13.2%), people who received Moderna showed higher reports of nausea &vomiting (23.3%) and diarrhea (6.7%). there is significant difference between vaccine type and respiratory and cardiac adverse effects of different vaccines among the studied group who received the first dose of vaccines, people who received AstraZeneca showed higher reports of Cough (5.3%), sore throat (5.3%), people who received Sinopharm showed higher reports of runny nose (10%) followed by Pfizer vaccine (8.8%). people who received Sputnik showed higher reports of palpitation (13.7%) followed by Moderna vaccine (11.7%). Chest pain and dyspnea appeared only with Pfizer vaccine in (2.5%) of cases. there is significant difference between vaccine type and adverse side effects of different vaccines among the studied group who had received the second dose only or complete the third dose of vaccine, people who received AstraZeneca showed higher reports of fever (33.2%) followed by Pfizer (29.3%), also showed higher reports of myalgia (56%), and arthralgia (33.2%). Pfizer showed higher reports of local pain (89.3%) followed by AstraZeneca (84.8%). people who received

Moderna showed higher reports headache (50%), chills (25.9%), skin rash (12.1%) and dizziness (6.9%). Sinopharm vaccine was the highest vaccine with no side effects (52.3%) followed by Sinovac (37%). Also, Xia et al. [16] reported that the vaccine made by AstraZeneca, ChAdOx1, had the highest rate of local and systemic adverse events, whereas the vaccine made by Modena, mRNA1273, had the lowest rate. On the contrary, Meo et al. [16] concluded that there was a greater occurrence of adverse events with mRNA1273 (Moderna). Also, Al Khames et al. [18] found that, the lowest rate of adverse events was seen for BBIBP-CorV (Sinopharm, Beijing, China). In addition, Mulligan et al. [19] stated that Six hundred and ten (68.5%) people reported negative reactions after receiving the Pfizer-BioNTech vaccine. Age > 35, higher educational status, higher income, individuals with comorbidities, and those who had a history of previous infection with COVID-19 all reported a significantly higher percentage of adverse effects after receiving the Pfizer-BioNTech vaccine, as did those who had a history of COVID-19 infection in the past. Moreover, Beatty et al. [20] showed that In comparison to Pfizer-BioNTech vaccine users, Sinopharm vaccine recipients are 2.9 times more likely to experience bad effects after the first dosage (p 0.001), but Pfizer-BioNTech vaccine recipients are only 1.4 times more likely to experience adverse effects after the second dose (p: 0.007). Also, Sunjaya et al. [21] reported that 5629 out of 8682 (64.9%) participants who took Pfizer 1273 for the first time reported experiencing unpleasant effects after taking just one dose. 11 140 out of 11 141 participants completed the adverse effects survey after receiving either 1 or 2 doses of Pfizer 1273, and 8947 (80.3 percent) reported experiencing unpleasant effects. Fatigue, muscular pain, headache, chills, redness, edema, joint pain, and fever were the most common side effects after vaccination.

In the present study we found that there is significant difference between vaccine type and abdominal adverse side effects of different vaccines among the studied group who had received the second and third dose of vaccine, people who received AstraZeneca showed higher reports of abdominal pain (5.4%), only people who received Sputnik showed reports of diarrhea (2%). there is significant difference between vaccine type and respiratory and cardiac adverse effects of different vaccines among the studied group who received the second and third dose of vaccines, people who received Sinopharm showed higher reports of sore throat (5.6%), and runny nose (8.4%) followed by Pfizer vaccine (8%). Also, people who received Moderna vaccine showed higher reports of palpitation (6.9%) followed by Sputnik (6.1%). Chest pain and dyspnea appeared only with Moderna vaccine in (1.7%) of cases. This agreed with, Hatmal et al. [22] who revealed that with an odds ratio of 1.39, more people who received the mRNA Pfizer-BioNTech vaccine experienced side effects than those who received the inactive Sinopharm vaccine; however, more people who received the Sinopharm vaccine (four out of ten) reported no side effects after vaccination than those who received the Pfizer-BioNTech vaccine (three out of ten). On the other hand, Ramasamy et al. [15] stated that 574 people, or 61%, of those who received the Sinopharm vaccine and afterwards experienced side effects spoke up about them. Participants younger than 55 years old, females, those with higher educational status (graduate/postgraduate), and those with associated comorbidities all reported a significantly higher percentage of adverse effects after receiving the Sinopharm vaccine, according to an analysis of several factors related to reactogenicity.

LIMITATIONS

The current study was done in one center on a relatively small sample size; it is required to do additional research, including longer follow-up and multicenter practice.

CONCLUSION

COVID-19 is a pandemic that has spread all over the world and caused significant disruptions in the economic, political, and cultural life of people everywhere. As prevention and treatment options for COVID-19 become scarcer, vaccinations against the virus became increasingly important. Affordable, effective, safe, and easily transportable vaccines are urgently needed to put a stop to the pandemic crisis. Vaccinations against COVID-19 do not come without danger, but no vaccine does. Mild symptoms are typical for the short-term side effects of the COVID-19 vaccinations. Pain and swelling at the injection site, fever, headache, muscle aches, and chills are

the most common adverse reactions. Safest vaccine was Sinovac, dangerous side effects as dyspnea and chest pain were associated with Pfizer vaccine while the vaccine accompanied by many side effects was Astrazeneca.

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(Table S1): Survey of adverse effects following COVID-19 vaccination.

Variable	Options	Tick here
Gender	Male	☐
	Female	☐
Age		
Occupation	Physician	☐
	Mrs /Nurse	☐
	Staff members	☐
	Employee	☐
	Worker	☐
Smoking	Smoker	☐
	Non smoker	☐

Section 1: Socio-demographics

Section 2: Sample Characteristics

1- Do you have any known allergies with specific substances?	☐ Yes	☐ No

2- Do you have any of the following chronic diseases?

Hypertension ☐	Diabetes mellitus ☐	Cardiac disorder ☐	Respiratory disorder ☐	Liver disorder ☐	Renal disorder ☐
Cancer ☐	obesity ☐	Autoimmune disease ☐	Thyroid disorder ☐	No ☐	Others(kindly specify)

3-Did you have documented COVID-19 infection before vaccination?	☐ Yes	☐ No

4- If yes, how long before vaccination?

5- Which COVID-19 vaccine did you receive?

☐ pfizer	☐ Moderna	☐ Johnson	Sinopharm ☐	Astrazeneca ☐	☐ Sinovac	☐ Sputink

6-How many doses of the vaccine have you received?

☐ One	☐ Two	☐ Three

7- What is the duration duration between each other?

8-If you have received one dose only, why you do not receive the other?

9-In case of experiencing any adverse effects after which dose did you experience them?

☐ First	☐ Second	☐ Third

10--Adverse effects (Tick all that apply)

Fever	Yes ☐	No ☐
Local pain or redness	Yes ☐	No ☐
Chills	Yes ☐	No ☐
Headache	Yes ☐	No ☐

Myalgia	Yes ☐	No ☐
joints pain	Yes ☐	No ☐
Nausea & vomiting	Yes ☐	No ☐
Diarrhea	Yes ☐	No ☐
Abdominal pain	Yes ☐	No ☐
Fatigue / tiredness	Yes ☐	No ☐
Skin rash / irritation	Yes ☐	No ☐
Sore throat	Yes ☐	No ☐
Cough	Yes ☐	No ☐
Runny nose	Yes ☐	No ☐
Numbness and tingling in limbs	Yes ☐	No ☐
Chest pain	Yes ☐	No ☐
Dyspnea	Yes ☐	No ☐
Palpitation	Yes ☐	No ☐
Tremors	Yes ☐	No ☐
Dizziness	Yes ☐	No ☐
No	Yes ☐	No ☐
Others (if "yes" kindly specify)		

11-When did these adverse effects appear?

During 1st day ☐	During 2nd day ☐	During or after 3rd day ☐

12- How long did these adverse effects last?

A day ☐	Two days ☐	Three days or more ☐

13- How did you act to relieve these adverse effects?

Just rest at home ☐	Symptomatic treatment ☐	Visit a doctor ☐	hospitalization ☐

14-Did you have documented COVID-19 infection after vaccination? ☐ Yes ☐ No

15- If yes, after how long from vaccination?

16-Do you advice others to get vaccinated for COVID-19? ☐ Yes ☐ No

Table (S2): Comparing adverse effects after vaccination and both comorbidities and COVID 19 infection before vaccination within the studied group**.**

Characteristic			Adverse effects		Test	P value
			Yes (n=946)	No (n=95)	X^2	
Comorbidities	Yes	N	292	4	41.53	**<0.001***
		%	98.6%	1.4%		
	No	N	654	91		
		%	87.8%	12.2%		
COVID 19 infection before vaccination	Yes	N	39	2	32.22	**<0.001***
		%	95.1%	4.9%		
	No	N	907	93		
		%	90.7%	9.3%		

Chi-Square Tests (x2)