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Evaluation of side effects associated with global COVID-19 vaccines in Iraq

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ABSTRACT: Since the start of the pandemic of COVID-19, it was clear that vaccination was the best way to combat it. A few vaccines were produced and approved in the last year. Many questions about the vaccinations' efficacy and safety arose due to this unprecedented vaccine development effort. This study aimed to evaluate the short-term side effects after receiving the available COVID-19 vaccines by the students of the Kut university college. This research was conducted as a cross-sectional, retrospective study using an online questionnaire distributed among COVID-19 vaccine recipients. The number of students who are enrolled in this study is 804, nearly (81%) of our study subjects were symptomatic after receiving the vaccination. Participants with a history of SARS-CoV-2 infection, comorbid diseases, females, non-smokers, and AstraZeneca vaccine receivers showed significantly (p<0.05) more severe side effects. In conclusion, the side effects described by our undergraduate students after receiving vaccinations from Pfizer BioNTech, Oxford AstraZeneca, and Sinopharm are similar to those reported in clinical trials, showing that these vaccines have safe profiles. More research is needed to assess the efficiency of current vaccinations in preventing SARS-CoV-2 reinfections.

KEYWORDS: COVID-19; SARS-CoV-2; vaccine; side effects.

1. INTRODUCTION

The pandemic of COVID-19 is a worldwide health crisis that has completely crumpled the international community, and it is continuing to spread worldwide, causing a global pandemic. One of the low-cost and most effective measures is vaccination [1]. Currently, nine COVID-19 vaccines have been approved for marketing worldwide, and as of February 13, 2022, more than 10,227,670,521 doses of COVID-19 vaccines have been globally administered (WHO, 2022). The rate of vaccination is directly linked to herd immunity, and substantial population immunity can only be attained if the vast majority of people are vaccinated. However, studies have shown that after introducing the COVID-19 Vaccine, vaccination willingness differs among nations and communities and is impacted by a variety of factors [2]. According to the Iraqi Ministry of Health, 9,395,121 people were vaccinated in Iraq. Vaccines with long protection periods, high effectiveness, and low incidence of adverse reactions were positively accepted by the population. In an online survey of 647 college students, researchers showed that 91% of college students are willing and ready to get Vaccinated [3]. The mRNA vaccine (Pfizer BioNTech) was approved for emergency use on December 31, 2020, and the adenoviral vector vaccines ChAdOx1 nCoV-19 (AstraZeneca-Oxford) was approved on February 15, 2021 [4, 5]. The efficacy of the AstraZeneca and Pfizer vaccines was determined to be 76% and 91%, respectively. Sinopharm (Beijing, China) developed an inactivated SARS-CoV-2 vaccination called BBIBP-CorV. With a seroconversion rate of 92%, it is safe and effective; nevertheless, its T- lymphocytes responses following vaccination are modest in comparison to the other two, resulting in low efficiency [6,7]. Despite this, Sinopharm was the first vaccination to be delivered to Iraqi citizens, which was acceptable because the WHO's target efficacy was greater than 50%.

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According to several types of research conducted around the world, fear of vaccine symptoms is the most prominent and common explanation for vaccination aversion [8]. In many countries, there are some misconceptions about COVID-19 vaccines; some people believe that these vaccines are used in covert operations. Other reasons contributing to low vaccine compliance include potential side effects and a lack of faith in vaccine manufacturers [7-9]. These worries prompted researchers to conduct a study on the after-COVID-19 vaccination adverse effects of the various vaccine companies accessible in Iraq. The study's goals are to assess the short-term side effects associated with the receivement of the three COVID-19 vaccines available in Iraq (Sinopharm BBIBP-CorV, Pfizer-BioNTech and AstraZeneca-Oxford).

2. RESULTS

2.1. Student's demographic characteristics and health risk conditions

Our final sample consists of 804 undergraduate students with a median age of 21 years, of whom 40% were males, and 60% were females. Most of the participants received Pfizer-BioNTech (81%), followed by Sinopharm-BBIBP-CorV (13%) and Oxford-AstraZeneca (6%). Approximately 72% of the study subjects have received two doses of the same Vaccine, and 28% received only one dose. 81% of the participants in our study have experienced side effects due to the COVID-19 vaccines. Females reported significantly (p<0.05) more severe side effects as compared to males. Out of 804 participants, 336 (42%) with a history of COVID-19 infection reported significantly (p<0.05) more severe side effects. Furthermore, 114 (14%) study subjects who have comorbid conditions experienced significantly (p<0.05) more severe side effects as compared to the study subjects with no history of chronic diseases as shown in table 1. On the other hand, the majority of the participants reported no difference in the severity of the side effects between the first dose and second dose of the same Vaccine. Moreover, 121 (15%) smokers experienced significantly (p<0.05) less severe side effects compared to non-smokers. Furthermore, the severity of the side effects that were reported by the study subjects who received the Oxford-AstraZeneca vaccine was significantly (p<0.05) more compared to the individuals who received Pfizer-BioNTech and Sinopharm-BBIBP-CorV vaccines. Additionally, there were no significant differences in the severity of the side effects between the first and second doses of the vaccines.

Table 1. Variables correlation with severity of symptoms (N=804).

Variables	No side effects	Mild	Moderate	Severe	p value
Sex					
Male	**87 (10.8%)**	**125 (15.5%)**	**88 (10.9%)**	**15 (1.8%)**	**<0.0001**
Female	**68 (8.5%)**	**170 (21%)**	**175 (22%)**	**76 (9.5%)**	
History of infection with Covid-19					
Yes	**38 (4.7%)**	**108 (13.4%)**	**144 (18.1%)**	**46 (5.7%)**	**<0.0001**
No	**117 (14.5%)**	**187 (23.1%)**	**119 (14.7%)**	**45(5.8%)**	
History of chronic diseases					
Yes	**14 (1.7%)**	**36 (4.5%)**	**43 (5.2%)**	**21 (2.6%)**	**0.01**
No	**141 (17.5%)**	**259 (32.2%)**	**220 (27.3%)**	**70 (8.7%)**	
Smoking					
Yes	**34 (4.2%)**	**39 (4.8%)**	**41 (5%)**	**7 (0.9%)**	**0.015**
No	**121 (14.8%)**	**256 (32%)**	**222 (27.5%)**	**84 (10.4%)**	
Type of Vaccine					
Sinopharm	**35 (4.4%)**	**46 (5.7%)**	**18 (2.3%)**	**6 (0.8%)**	**<0.0001**
Pfizer	**117 (14.5%)**	**237 (29.6%)**	**225 (28.2%)**	**72 (8.9%)**	
AstraZeneca	**4 (0.5%)**	**12 (1.5%)**	**16 (2%)**	**16 (2%)**	

2.2. Students who reported side effects after receiving the vaccination

The vast majority of our participants (81%) reported side effects after receiving COVID-19 vaccines, of which 37% were mild, 33% were moderate, and 11% were severe side effects (Figure 1).

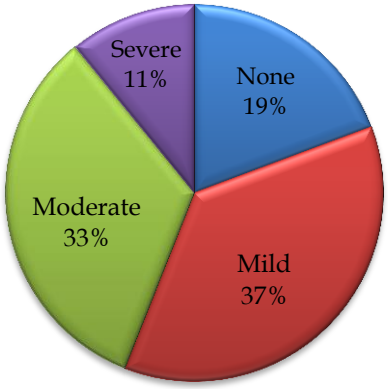

Figure 1. Severity of the side effects for COVID-19 vaccines.

33% of participants took analgesics to relieve the side effects, 6% sought medical consultation, and 2% were admitted to the hospital. The side effects length lasted for one day for 48% of the participants and from one to three days for 40% of them, with only 12% reporting a prolonged period of the side effects (more than three days). 59% of the students who showed side effects took rest, 33% used analgesic, 6% sought doctor consultation, and 2% were admitted to the hospital as shown in (Figure 2).

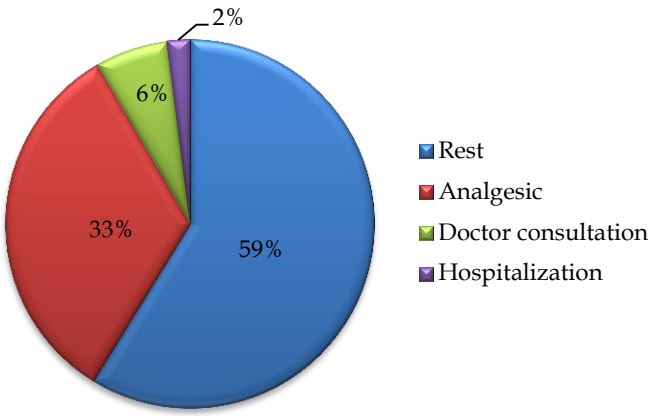

Figure 2. Participants' actions to relieve side effects.

Explicitly, pain in the arm and injection site reaction was the most commonly reported side effects among our study participants who received Sinopharm BBIBP-CorV, Pfizer-BioNTech and AstraZeneca-Oxford were (61%, 87% and 88%) and fever was reported in (47%, 67% and 83%) of the students respectively as shown in Table 2. Fatigue, headache and myalgia were reported by the majority of the participants of our study. However, arthralgia, hypotension, chill, palpitation, shortness of breath, sore throat, cough, nausea, severe allergic reaction, diarrhea and vomiting were less commonly reported by our study participants as shown in (Figure 3) and a detailed comparison for each type of vaccine shown in (Table 2).

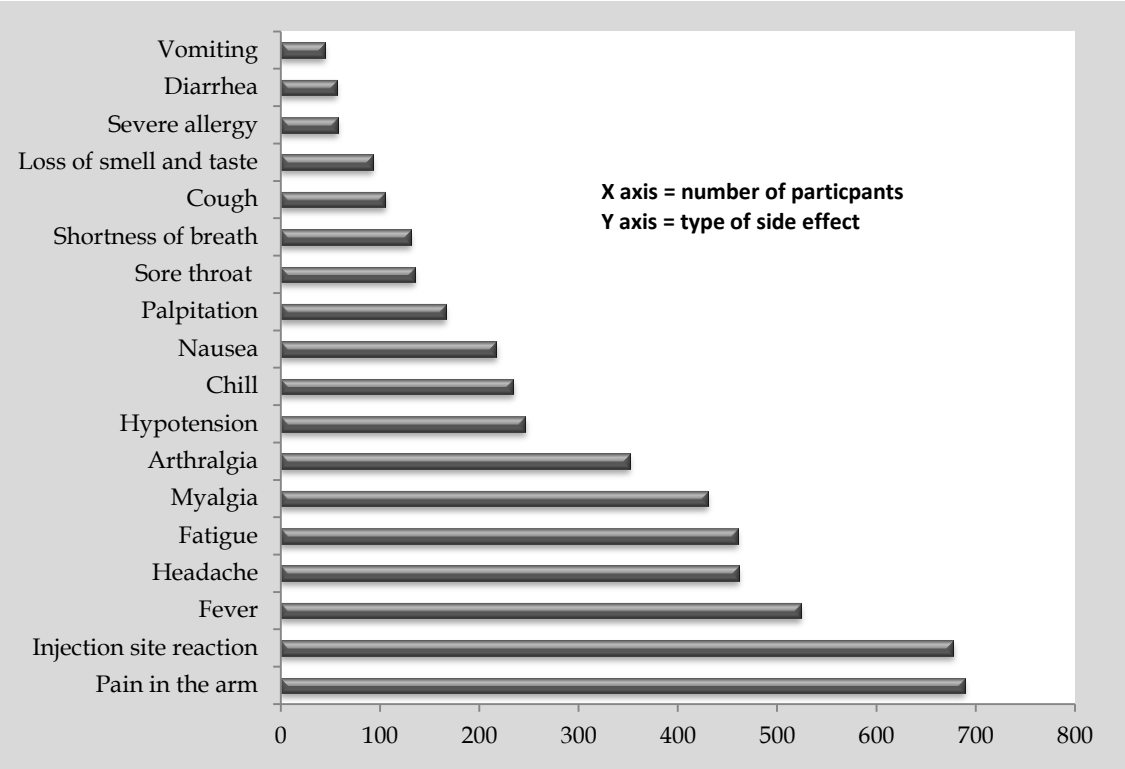

Figure 3. Side effects that appeared after receiving COVID-19 vaccines.

Table 2: Adverse reactions to different vaccines (N=804).

Symptoms	Sinopharm (N=105)	Pfizer (N=651)	AstraZeneca (N=48)
Pain in the arm	**61%**	**87%**	**88%**
Injection site reaction	**66%**	**88%**	**71%**
Fever	**47%**	**67%**	**83%**
Headache	**49%**	**58%**	**67%**
Fatigue	**41%**	**58%**	**87%**
Myalgia	**36%**	**55%**	**75%**
Arthralgia	**34%**	**44%**	**67%**
Hypotension	**30%**	**30%**	**42%**
Chill	**23%**	**30%**	**42%**
Nausea	**20%**	**27%**	**42%**
Palpitation	**25%**	**20%**	**12%**
Sore throat	**11%**	**18%**	**13%**
Shortness of breath	**9%**	**17%**	**17%**
Cough	**6%**	**14%**	**13%**
Loss of smell and taste	**9%**	**11%**	**16%**
Severe allergy	**8%**	**7%**	**8%**
Diarrhea	**7%**	**7%**	**8%**
Vomiting	**2%**	**6%**	**8%**

3. DISCUSSION

Most countries have taken precautionary measures to restrict SARS-CoV-2 transmission since the start of the COVID-19 pandemic in January 2020 in the hopes of speedy manufacturing of safe and effective vaccines. As a result, several types of vaccination were developed around the same time, with only a few of them receiving emergency use authorization around the world [10]. Iraq is one of the countries that has begun an early vaccination campaign as part of its unprecedented efforts and initiatives to stop the spread of COVID-19 [8]. Despite the Vaccine's availability to the population, there is a wide range of people's willingness to take it, which is likely owing to the fact that these vaccinations were developed in a short period of time compared to previously approved vaccines, which take years to get approved [11-13]. Another reason for this variation could be the use of mRNA vaccines, a relatively novel technology for several of the COVID-19 vaccines [14]. These two key considerations may cause some people to be concerned about possible severe side effects, despite the fact that multiple publications explaining the expected adverse effects have recently been published [15-17]. As a result, the goal of this study was to assess the side effects of the COVID 19 vaccinations, which are now in use in Iraq. We gathered information from students at Kut university college who received Sinopharm BBIBP-CorV, Pfizer-BioNTech and AstraZeneca-Oxford in Iraq. All of these vaccines have documented side effects, with the percentage varying depending on the individual's age, kind, and dose [8]. Approximately 81% of the participants in our study reported side effects. Gender differences were seen reading the severity of the side effects as women reported more severe side effects. These findings are largely compatible with data reports from the Centre for Disease Control (CDC) in the USA [18]. In general, females are inclined to develop stronger immune responses than males, and gender was a significant risk factor for adverse effects for the COVID-19 vaccination [19-21]. Furthermore, participants with a history of SARS CoV-2 infection and comorbid diseases reported more severe side effects. Similar results were reported in middle eastern countries, particularly Saudi Arabia and Jordan [7, 8]. Our data showed that Oxford AstraZeneca vaccination participants were more likely to experience side effects than the other two vaccine recipients. This finding has also been mentioned in other publications [20]. According to our research data, the most commonly reported side effects were a pain in the arm and injection site reaction, which occurred the same day as the injection and lasted for around one day, consistent with other research studies [9, 15, 19, 20]. On the other hand, most participants in our study reported fever, headache, feeling fatigued, and generalized muscle pain, which can be explained by the fact that our participants were younger (median age of 21 years) than those in other studies. Younger people reported a higher frequency of adverse effects than older people since they have brusquer immune systems [5, 22]. Moreover, participants reported significantly more fever and headache after the second dose compared to after the first dose. Recent research has shown that the initial dose of vaccination triggers an innate immune response, which is an inflammatory response that happens when the virus enters the body and triggers an adaptive immune response, triggered by the vaccine antigens or vaccine components. After the first dose induces the development of virus-specific antibodies, the second dose prompts a much stronger immune response generated by memory T cells and B cells [23]. Furthermore, our data revealed that participants who are smokers showed significantly less severe side effects than participants who are non-smokers. Smoking's adverse effects on the immune function appear to be determined by a number of pathways that affect both humoral and cellular immune responses. Various studies have found that smoking significantly reduced immunoglobulin production of IgA, IgM, and IgG and also decreased immune cells counts (lymphocytes, dendritic cells monocytes and macrophages) [24-27]. Furthermore, a recently published study by Ferrara et al. suggested that there was diminished ability to form memory cells that are critical to the maintenance of the protective immune response induced by vaccines [25].

Despite being one of the few Iraq studies exploring the side effects of COVID-19 vaccines, our study has limitations. The data have been collected by a self-administered online questionnaire, which could result in reporting bias since it was conducted only among young age participants who have the skills to fill an online survey. Further community-based studies are required to have more age groups included.

4. CONCLUSION

Despite significant disparities in the presence and severity of side effects associated with receiving the current licensed vaccines in Iraq, the current study indicated that the majority of post-vaccination complications were mild to moderate side effects and only a few patients needed to see a doctor or to be admitted to the hospital. Participants with a history of smoking, previous COVID-19 infection,

comorbidities, females, and AstraZeneca vaccine users were all linked to a more severe post-vaccination side effects. A larger follow-up study is needed to assess the vaccines' effectiveness in controlling and preventing SARSCoV2 infection, as well as their long-term side effects.

5. MATERIALS AND METHODS

5.1. Ethical considerations

The project proposal was presented to the Chair of the Research Ethics Committee of Kut University College. Participants' received consent letters from the center. KUC/1472/2021-036 was issued as formal ethical approval after all of these processes were completed and in accordance with international criteria.

5.2. Study sample

The size of the sample was calculated using raosoft.com. The ministry of health in Iraq announced the number of vaccinated people were 9,395,121. Subsequently, a sample size of 385 was determined to be satisfactory to give a 95% confidence interval with a 5% margin of error. A total number of 804 participants were recruited in this study.

5.2.1. Inclusion criteria

Undergraduate students of Kut university college who had received Pfizer-BioNTech, AstraZeneca-Oxford or Sinopharm vaccines.

5.2.2. Exclusion criteria

All students who didn't receive the vaccination or who had received a vaccine other than Pfizer-BioNTech, AstraZeneca-Oxford and Sinopharm vaccines.

5.3. Validity and reliability

The study's survey tool was developed after an extensive literature search. As a result, potential post-vaccination side effects were identified and covered in this survey. Several questions were also added to record participants' demographic data and to assess their general health status. The survey tool was written in Arabic, and it was validated by a panel of experts who provided feedback on the different items of the survey. To test the comprehensibility and clarity of survey content, a pilot study was conducted by including 30 respondents who were excluded from the formal evaluation, and further modifications were done based on their remarks. To assess the reliability of the survey tool, the Cronbach's alpha test of internal consistency was used. The test suggested that the survey tool was reliable overall, and Cronbach's alpha was equal to 0.74, which is above 0.70 as a general cut-off limit. The survey tool's final edition had three sections. The first section included demographic information and the medical history of the participants. The second section looked at the types of vaccines and the number of doses. The third section had potential post-vaccination side effects.

5.4. Study design

A cross-sectional study was performed in November 2021 among undergraduate students of Kut university college who received COVID-19 Pfizer-BioNTech, AstraZeneca-Oxford and Sinopharm vaccines. They were asked to participate in a self-administered online survey (created with Google Forms) circulated via social media platforms (i.e., Telegram and WhatsApp). Study subjects were directed to a page that included a comprehensive description of the study's purpose before being asked to accept a mandatory electronic informed consent form that included statements about anonymity and voluntary participation. Study subjects were questioned about side effects associated with receiving covid-19 vaccines and the severity was assessed based on 4-points verbal rating scale (none, mild, moderate and severe) [28].

5.5. Data analysis

The normality of the variables was checked using the Shapiro–Wilk test. Simple descriptive methods, median for continuous variables, frequencies, and percentage were evaluated using parametric tests according to the normally distributed nature of the data. Chi-square and Fisher's exact tests were used to evaluate the symptoms that appear after vaccination. *P* value <0.05 and Odds Ratio of 1 were considered statistically significant. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23 (IBM SPSS, Armonk, NY, USA).

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Conflict of interest statement: The authors declare that there is no conflict of interests regarding the publication of this paper.

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