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Research article

Symptoms and Complications Associated with COVID-19 Infection and Its Vaccination in Iraq: A Cross-sectional Study

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Keywords

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Abstract

The aim of this study was to determine the effectiveness of vaccinations in providing immunity to vaccinated individuals in Iraq and to investigate the potential side effects of COVID-19 vaccines and the risk factors associated with virus infection. The research was conducted at the University of Basrah, where respondents were polled in February 2022 about their history of getting the Corona Virus 2019 vaccine and their history of getting infected with the virus before getting the vaccine. In addition, the questionnaire included questions about symptoms during infection, infection severity, health problems faced after recovery, the number of infection instances before and after vaccination, and side effects after vaccination. People were also questioned about their past ailments and some of their behaviors. According to findings, 55.1% of individuals had not been infected (who had no previous history of virus infection), while 44.9%, consisting in 46.4% females and 41.3% males, had been infected. The majority of infected individuals developed a fever and a loss of smell and taste. Shortness of breath and coughing, among other symptoms, were reported by almost all of the other affected patients. Recovery duration for those infected with the virus ranged from one to five weeks. The research discovered that all of the vaccinated participants with any of the three vaccinations were immune and that immunization protected them against viral infection. On the other hand, the side effects connected with the three immunizations were ranged from mild to severe, including fever, joint pains, vomiting, and anorexia, etc.

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1. Introduction

On 7 January 2020, scientists were able to isolate and identify the virus responsible for the outbreak of pneumonia cases that began in Wuhan City on December 31, 2020. It was determined to be 96% genetically similar to the RaTG13 strain, suggesting that the disease originated in bats. SARS (Severe Acute Respiratory Syndrome) is a kind of acute respiratory syndrome. Coronavirus 2 (SARS-CoV-2) is a beta variant of the Coronaviridae family that spreads by droplet transmission from more than 5 m to 1 m. Influenza-like symptoms are most common because the upper and lower respiratory tracts are infected; however, sites where the ACE2 receptor can be located, such as the colon, heart, and kidneys, can also be impacted. SARS-CoV-2 carriers can be symptomatic or asymptomatic [1]. The 10 most common reported symptoms, according to a pooled analysis of prevalence data, were diarrhoea, headaches, muscle and joint pain, weariness, and chest pain. Cognitive decline, memory loss, anxiety, and sleep issues were other frequent symptoms. People with lengthy COVID frequently reported poor quality of life, mental health concerns, and employment issues in addition to symptoms and complications. These people could need multidisciplinary care that includes monitoring of symptoms over time to spot potential consequences, and to facilitate physical rehabilitation, mental health care, and assistance from social services. In order to assure quick and effective responses to upcoming health concerns, resilient healthcare systems are required [2].

Smallpox, measles, and chickenpox are illnesses from which people can become fully immune and never be sick again after being afflicted. However, other infections, such as the flu, can strike individuals several times. Consequently, immunity must be deliberately generated in the human body to get rid of infection, and this process is known as “active immunization” [3]. Vaccines have now been created for over 20 illnesses, some of which are common and others unique to certain situations. The choice to create and use a vaccine for a disease is based on balancing the necessity for the vaccine and the risks and problems associated with it [4].

Injecting a weakened virus into the body causes a mild version of the disease. Vaccination, often known as active immunization, is an essential and cost-effective means of avoiding infectious diseases. The incidence of numerous deadly illnesses among newborns, children, and adults has fallen dramatically since the worldwide deployment of universal vaccination programs. With effective vaccination in children, serious illnesses such as diphtheria, tetanus, pertussis, measles, and polio have decreased considerably [5].

Herd immunity, like immunity to smallpox, may exist worldwide. Although universal immunity to polio and measles does not yet exist, the United States and many other nations have attained herd immunity to these two illnesses [6]. Herd immunity is formed when many individuals are immune and new instances are avoided. This indicates that the community has enough people protected to prevent transmission from person to person [7]. The vaccine’s prophylactic impact is determined by the number of afflicted individuals in the two groups of vaccinated and unvaccinated people who are accidentally exposed to the disease. The most effective vaccines mimic the disease’s protective function throughout the healing period [8].

There are currently multiple effective and authorized COVID-19 vaccines, with three vaccines having effectiveness of more than 90% (Pfizer–BioNTech, 95%; Moderna, 94%; and Sputnik V, 92%) as well as Oxford–AstraZeneca vaccine [9]. Moreover, the WHO reported on June 1st, 2021 that another Chinese vaccine, developed in Beijing by the state-owned firm Sinopharm, had a 79% efficiency against symptomatic disease [10]. There are currently three vaccines available for COVID-19 in Iraq: Sinopharm, AstraZeneca-Oxford, and Pfizer- BioNTech [11]. The Pfizer and Moderna mRNA-based vaccines have drawn the most attention in regards to vaccination side effects due to their quick development and production. These side effects, like those from other vaccines, can sporadically be brought on by local allergic reactions with a delayed onset [12, 13]. However,

after the second dose of the vaccinations, 60% of recipients report a mix of fever, headache, myalgia, and general malaise as their main symptom. These symptoms can be unsettling, and they have generated discussion in the media and in renowned academic journals. However, the precise origin of the adverse effects has gotten very little attention, save from a few hazy references to a continuous immunological response [14]. The current study aimed to investigate the risk factors associated with COVID-19 infection, reveal the role of vaccines in providing immunity to vaccinated people in Iraq and to study the possible side effects after taking COVID-19 vaccines.

2. Materials and Methods

2.1 Data gathering and survey details

The survey's (questionnaire) data were collected in February 2022 from students and faculty staff at the University of Basrah, College of Education in Qurna. Data were collected randomly via paper questionnaire and 432 samples were taken from students and faculty, consisting of 126 males and 306 females, of whom 396 (91.6%) were vaccinated. They were asked if they had already had one of the corona virus 2019 vaccines (Sinopharm, AstraZeneca-Oxford, and Pfizer-BioNTech) and also about the possibility that they had been infected with the virus prior to receiving the vaccination. Also, the questionnaire included questions concerning any symptoms, severity, and health problems they faced during infection the virus and after recovery. Furthermore, they were asked about the number of times they had been infected before and after vaccination and the accompanying side effects after vaccination with any type of vaccine. People were also asked about their illnesses and some of the practices they employed during the infection. When conduction this research, we acknowledge that we did not violate anyone's right and that we did not offend any people's personal information, such as name, address, phone number, email address, and so on.

2.2 Statistical analysis

The statistical analysis included the use of the application of SPSS ver.25 [15]. Analysis of data was done by Chi-square test at a significance level of 0.05.

3. Results and Discussion

3.1 COVID-19 infection, symptoms, complications, and recovery periods

According to the survey results, 432 samples were chosen from various societal categories. There were 306 (70.8%) females and 126 (29.2%) males, of age ranging from 20 to 40. The results revealed that 55.1% had not been affected by the virus (had no previous history of virus infection) while 44.9% had been affected, of whom 46.4% were female and 41.3% men, as shown in Table 1. Through Chi-square tests, we noted that the value of Chi-square was 0.951 at the significance value of 0.329, meaning that there were no statistically significant differences of the incidence of COVID-19 according to gender. Moreover, we noted that there were no statistically significant differences in taking the vaccine according to gender, as the value of Chi-square was 2.970 with a significance value of 0.085.

According to the associated symptoms, the results showed significant differences in the percentage of symptoms appearing after infection with COVID-19. Most infected patients had a fever and a sense of smell and taste loss. In contrast, other infected people had shortness of breath,

cough, and other symptoms. The other signs of infection are detailed in Table 1 and Figure 1. Statistically, depending on the symptoms and gender, it was found that there were significant differences between males and females (Chi-square 32,15; significance value 0.000). We noted that all symptoms were present in females in greater proportions than males except for the anorexia symptom, as shown in Figure 1.

People infected with the virus showed varying recovery periods, ranging from three days to five weeks (Chi-square value 10.086; significance value 0.039), as presented in Figure 2. Five infected individuals required hospitalization, while the remainder did not need admission to a hospital or intensive care unit (ICU). According to the responses, infection was primarily diagnosed in hospitals using the PCR smear test. There were significant differences in the number of infection times of the same individuals (the value of Chi-square is 672,459). The survey reveals that one individual was infected three times, 23 individuals had been infected two times, and the remainder were only infected once, as presented in Figure 3. Furthermore, the results showed that many individuals suffered from persistent symptoms following their recovery. These symptoms were colloquially called "long COVID" or "complications of infection". Most patients experienced memory issues, joint pain, and kidney issues, according to the findings. Hair loss and diabetes were also reported, as presented in Figure 4.

Table 1. The percentages of people infected with the coronavirus and percentages of people vaccinated, and the associated symptoms when infected with the coronavirus

A: The percentage of people infected with COVID-19 and vaccination percentages for survey participants, N (%)

Gender	Survey participants	Infected by COVID-19	Vaccinated
Male	126(29.2%)	52(41.3%)	120(95.2%)
Female	306(70.8%)	142(46.4%)	276(90.2%)
Total	432(100%)	194(44.9%)	396(91.6%)

B: The associated symptoms of people that were infected by COVID-19, (N)

Gender	a	b	c	d	e	f	g	h	i	j
Male	0	44	36	20	4	24	2	22	24	34
Female	6	128	120	54	14	16	22	72	82	98
Total	6	172	156	74	18	40	24	94	108	132

a, non; b, fever; c, a loss of sense of smell; d, dyspnea; e, vomit; f, anorexia; g, diarrheal; h, joint pain; i, fatigue; j, others. Statistically, depending on the gender variable, there is no statistically significant difference according to the numbers affected by COVID-19 (Chi-square is 0.951) and taking the vaccine (Chi-square 2.970). However, depending on the symptoms, there is statistically significant difference (Chi-square is 32,15).

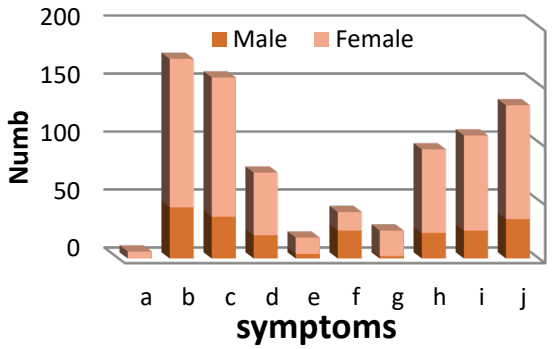


Figure 1. The symptoms after infection with COVID-19 (a= non; b=fever; c= loss of sense of smell; d= dyspnea; e= vomit; f= anorexia; g= diarrheal; h= joint pain; i= fatigue; j= other symptoms)

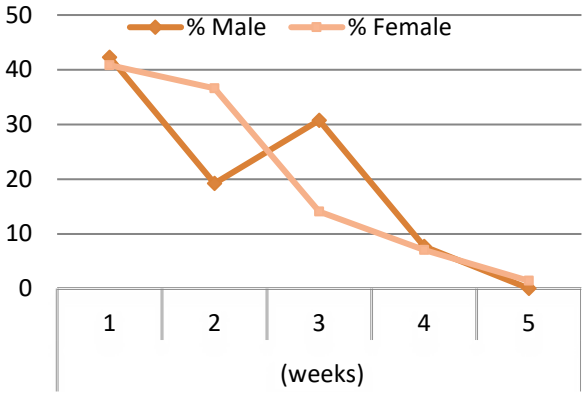


Figure 2. Periods of recovery between males and females from COVID-19 (1-5 weeks)

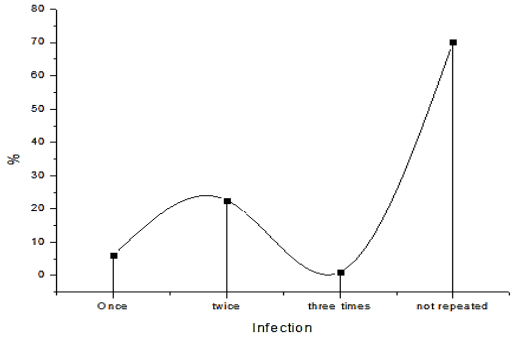


Figure 3. Percentage of re-infection by COVID-19

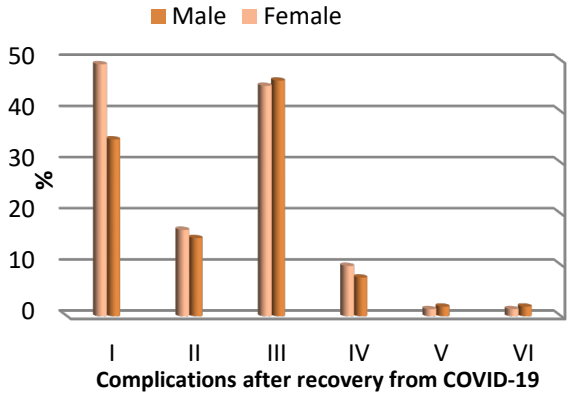


Figure 4. Percentage of complications and the risk factors after recovery from COVID-19 (I=non, II=memory, III=joint pain, IV=kidney issues, V=hair loss, VI=diabetes). Through Chi-square tests, we noted that the value of Chi-square was 1.450 with a significance value of 0.919. This means that there were no statistically significant differences in symptoms between males and females.

COVID-19 has become one of the world's most serious public health disasters in recent years. In order to produce a vaccine, several pharmaceutical corporations raced against the clock [16]. The coronavirus disease 2019 (COVID-19) pandemic began in Wuhan, China, and quickly expanded to other regions and nations. It causes severe respiratory infections, leading to pneumonia and lung failure. The virus that causes the disease is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a beta coronavirus that is genetically similar to the SARS-CoV that was initially identified in 2002 [17-20]. Infection with SARS-CoV-2 causes a broad spectrum of clinical consequences. Some people infected with SARS-CoV-2 are asymptomatic, while others develop mild to severe COVID-19 and COVID-19 pneumonia. This implication can result in some patients requiring acute care and, in extreme situations, leading to death, particularly in older people. The earliest and most accessible diagnostic information were symptoms such as fever, cough, or loss of smell or taste and indicators such as oxygen saturation [21]. These tendencies were in complete agreement with the results of the current study, where the results showed that there were significant differences in the percentage of symptoms appearing after infection with COVID-19. Most infected patients had a fever and a loss of sense of smell and taste, while other infected patients had shortness of breath and coughing, among other symptoms.

A median of 11 days was detected between positive and negative SARS-CoV-2 PCR testing of upper respiratory tract samples from COVID-19 patients. COVID-19 morbidity and death rates are more significant among older people. However, there is no separation of recovery durations in large population cohorts for distinct patient age groups [22]. In the current research, people infected with the virus recovered at various rates, ranging from one to five weeks. Only ten of those afflicted with the virus needed to be hospitalized, while the others were able to recover at home. Baud *et al*. [23] announced in March 2020 that they used a 14-day delay to calculate the correct fatality rate during the COVID-19 pandemic. According to their findings, the traditional death rate undervalues the likely harm posed by COVID-19 in symptomatic individuals. In addition to mortality rates, the recovery rate was considered when assessing the COVID-19 pandemic's austerity. The recovery period must be considered when determining both mortality and recovery rates; indeed, it is impossible to calculate mortality and recovery rates without considering the time for recovery. In general, Baud *et al*. [23] assumed a 14-day recovery period for COVID-19.

According to the number of times the virus has repeatedly infected individuals, 46 people were discovered to be infected twice, two people had been infected three times, and the remainder had only been infected once with the disease. The current results differed from Ota's study [24]. It was based on the hypothesis that immunity acquired after a primary SARS-CoV-2 infection may protect against subsequent SARS-CoV-2 infection if many people develop several SARS-CoV-2 infections after their first infection. Even though most COVID-19 patients were healed and released, a small percentage of these patients had re-positive RT-PCR tests during the follow-up period [25]. The exact etiology of this re-infection is unknown. Both immunoglobulin M (IgM) and immunoglobulin G (IgG) antibodies dramatically rose during a short period in typical COVID-19 patients [26]. In a case series report, the IgG levels in re-infected COVID-19 subjects were relatively low [27].

3.2 COVID-19 infection and smoking

Through the results of Chi-square tests, we note that the value of Chi-Square is 0.051 with a significance value of 0.822, that is, there are no statistically significant differences in the incidence between smokers and non-smokers. Because of the substantial data demonstrating the harmful impact of tobacco use on lung health, smoking has been thought to be connected with a poor prognosis. It has also been discovered to harm the immune system and its ability to respond to infections, rendering smokers more susceptible to infectious illnesses [28]. Smoking increases the frequency and severity of lung infections due to damage to the upper airways and a loss in pulmonary immune function [29]. However, whether smoking causes severe symptoms and mortality in COVID-19 individuals is still debatable. Previous research found a link between current and past smoking, never smoking, and COVID-19 unfavorable consequences [30]. In other research, COVID-19 patients who were non-smokers and former smokers did not differ in severity or fatality [31, 32]. This concept reinforces the current study results in that smoking either increased or reduced infection because the incidence of smokers and non-smokers in the results did not differ much (Figure 5). Thus, there is no apparent effect on the increase or decrease in the incidence of coronavirus.

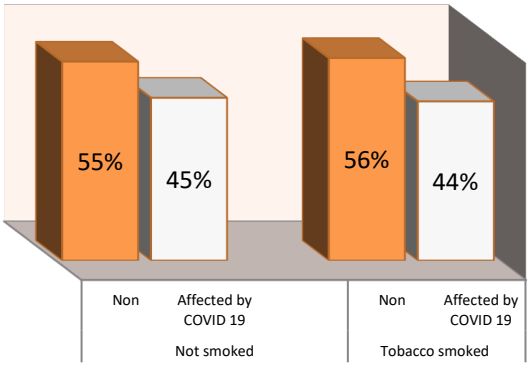


Figure 5. Percentage of infection by COVID-19 between people tobacco smoke and non-smoke

3.3 Vaccination, side effects, and immunization

Through Chi-square Tests, the value of Chi-square was 306.197 with a significance value of 0.000, indicating there were significant differences in the numbers of people who had received different type of vaccines. The Pfizer vaccine was the most popular, followed by Sinopharm then AstraZeneca. According to the survey, 284 persons (72%) received the Pfizer vaccination, 104 (27%) received the Sinopharm vaccine, and only four (1%) received the AstraZeneca vaccine, as shown in Figure 6. Based on the previous three vaccinations, the questionnaire indicated that all vaccinated individuals were immune, and apparently the vaccines adequately prevented viral infection until the survey was conducted in February 2022. However, there was a distinct variation in the side effects associated with each of the three vaccines.

The side effects were distributed between simple, moderate and severe levels, and symptoms included fever, joint pain, vomiting, dizziness, loss of sense of smell and taste, anorexia, and so on, as illustrated in Figure 7. It is worth noting that among those who participated in answering the questionnaires, 18.3% of the people who received Pfizer vaccine and 39.6% of the Sinopharm vaccinate people experienced no side effects. Statistically, there were no significant differences in the side effects in the vaccinated people according to the three types of vaccine, where the value of the Chi-square was equal to 2.040, with a significant value of 0.916.

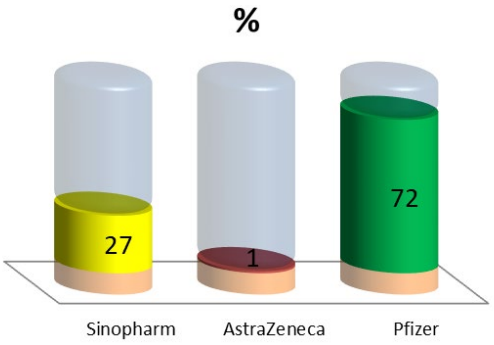
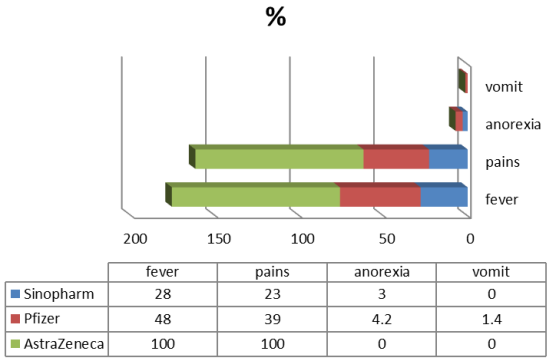


Figure 6. The proportion of vaccinated individuals by different vaccines



	fever	pains	anorexia	vomit
Sinopharm	28	23	3	0
Pfizer	48	39	4.2	1.4
AstraZeneca	100	100	0	0

Figure 7. The side effects after vaccination according to vaccine type

Vaccination coverage, including the COVID-19, is one of the most effective and cost-efficient health interventions for preventing infectious illnesses. Designing a COVID-19 vaccine that is both effective and safe is challenging. Production, storage, distribution, and administration were significant obstacles, particularly in impoverished countries [33]. Several factors were taken into account in developing the vaccine, including the selection of SARS-CoV-2 antigens, vaccine platform, and immunization regimens/routes. Vaccination platforms included live attenuated vaccine (LAV), inactivated virus vaccines, protein subunit vaccines, viral vector-based vaccines, and DNA or m-RNA vaccines [34, 35]. Vaccination programs are deemed successful when they have a high acceptance rate. However, when attempting to vaccinate the population in low- and high-income nations, specific concerns should be kept in mind [36-38].

According to the survey findings, the majority of individuals accepted the vaccination program based on the three accessible vaccines and 91.6% of them received the vaccine without fear in order to get the vaccine's protection. The current study results agree with Ghazi *et al*. [16], who indicated that the Iraqi population was highly willing to take the vaccine. Despite the high acceptability of vaccination among the Iraqi population in our study, people's desire to take the vaccine was even more remarkable. This might be since the research was conducted at a university, and the participants are more educated than people from other social groups. Furthermore, health institutions are almost compulsorily involved in persuading individuals to accept the vaccine when the vaccine is provided. Although vaccination is one of humanity's most significant public health achievements, a sizable portion of the population was skeptical of vaccine safety, efficacy, and necessity [39]. In general, high COVID-19 vaccination acceptance rates among students and health care providers are required to give recommendations and counselling to vaccine-hesitant people [40].

The present study revealed considerable variances among those who had been infected with the virus and who had complications of infection. According to the data, about 16.9% of patients reported memory problems, about 46% had joint pain and about 9.85% had renal disorders. Two hundred and eight articles were concerned with persistent COVID-19 symptons. Anosmia, ageusia, and headache were the most prevalent neurological symptoms of COVID-19. More severe problems such as stroke, impairment of consciousness, convulsions, and encephalopathy were also recorded [41]. Fever, dry cough, interstitial pneumonia, weariness, headache, and loss of taste and smell were all symptoms of COVID-19 [42]. While most COVID-19 patients had a positive result, a small percentage of them developed severe pneumonia, leading to ARDS and respiratory failure [43].

Recent immunological research has added to the evidence that the "cytokine storm" is caused by the enormous synthesis and release of pro-inflammatory cytokines and thus can trigger a negative immunological response, leading to ARDS and multi-organ dysfunction syndrome (MODS) [44]. Micro thrombosis, disseminated intravascular coagulation, and multi-organ failure are all symptoms of the cytokine storm. Coagulation pathways are activated during the immune response to infection, resulting in an imbalance between pro-and anticoagulant factors and micro thrombosis, disseminated intravascular coagulation, and multi-organ failure [45]. There are pulmonary concerns in addition to other problems such as acute cerebrovascular events, encephalitis, Guillain-Barré syndrome, acute necrotizing hemorrhagic encephalopathy, and hemophagocytic lymphohistiocytosis. Patients taking immunosuppressive medicines for pre-existing neurologic disorders are at higher risk of COVID-19 infection consequences, and several of the currently proposed COVID-19 treatments can interact with these drugs [46].

The questionnaire revealed that all vaccinated persons, who had received the three immunizations available in Iraq, had full immunity that was sufficient to protect them from viral sickness until the survey was done in February 2022. The side effects connected with the three immunizations, on the other hand, indicated a clear distinction. Consequently, the findings revealed various symptoms, ranging from mild to severe, and including fever, joint pain, vomiting, disorientation, loss of smell and taste, and anorexia. It is worth mentioning that 18.3% of Pfizer

vaccination recipients and 39.6% of Sinopharm vaccine recipients did not experience any side effects after receiving the vaccine. According to Gee *et al*. [47], 13,794,904 vaccination doses were given. Headache (22.4%), tiredness (16.5%), and dizziness were the most common complaints reported to Vaccine Adverse Event Reporting System (VAERS) (16.5%). There were 113 deaths reported to the VAERS, with 65% among long-term care facility (LTCF) residents. Available information from death certificates, autopsy reports, medical records, and clinical descriptions from VAERS reports and health care providers did not suggest a causal relationship between COVID-19 vaccination and death.

Only a few incidences of anaphylaxis have been documented after receiving both vaccinations (4.5 reported cases per million doses administered). Reactions reported to the v-safe system by those who got the Pfizer-BioNTech vaccination was more common after the second dosage than after the first. The two COVID-19 vaccines now in use have preliminary post-authorization safety profiles. Vaccines have been provided in over 2 billion doses over the world. Despite the remarkable speed with which vaccines are administered, many more individuals must be vaccinated and boosted before the intended epidemiological effects of vaccination can be achieved and maintained worldwide. Increased willingness to get vaccinated will be necessary as vaccine availability grows to enhance vaccination uptake. One explanation for vaccine apprehension is fear of vaccination-associated adverse effects, such as pain at the injection site, headache, myalgia, fever, and exhaustion. However, these effects are typically temporary. As a result, therapeutic pharmaceutical usage helps lessen the frequency and/or severity of vaccination-induced adverse effects while maintaining vaccine immunogenicity and effectiveness. COVID-19 vaccinations are effective and necessary for the ongoing pandemic's management [48]. This opinion is consistent with the current study results, which are based on the fact that vaccines provide full immunity.

4. Conclusions

Iraq has three COVID-19 vaccines: Sinopharm, AstraZeneca-Oxford, and Pfizer-BioNTech. There have been many side effects associated with the vaccines. The virus did not infect 55.1% of respondents, while 44.9%, including 46.4% of women and 41.3% of men, were infected. According to the accompanying symptoms when infected, the majority of infected patients had a fever and a loss of sense of smell and taste, and all other infected patients reported shortness of breath, coughing, and other symptoms. Infected individuals experienced recovery times ranging from one to five weeks. The study indicated that after three vaccinations, all vaccinated persons were completely immune, and had sufficient immunity to prevent viral infection until the survey was conducted in February 2022. According to the study results, there is the necessity of obtaining a vaccine to significantly reduce the spread of the virus.

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