Evaluating the Effectiveness of Pfizer, AstraZeneca, and Sinopharm Vaccines Against COVID-19 in Iraq: A Cross-Sectional Study of Vaccine Efficacy and Symptom Severity

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Abstract :

Background: In response to the COVID-19 pandemic, the rapid development of vaccines targeting the SARS-CoV-2 virus has been pivotal. These vaccines work by triggering antibody production to neutralize the virus. This study evaluates the efficacy of available COVID-19 vaccines in Iraq, contributing to public health knowledge in the region.

Methods: A cross-sectional analysis was performed using 1,233 Iraqi participants vaccinated with one of the available vaccines in Iraq, including Pfizer, AstraZeneca, or Sinopharm, and exposed to COVID-19 infection after their immunization. Most clinical evaluations were conducted with all participants.

Results: The study found that Pfizer vaccine recipients predominantly experienced mild COVID-19 symptoms, with fewer cases of moderate or severe symptoms. Those vaccinated with AstraZeneca mainly reported mild to moderate symptoms, with fewer severe or asymptomatic cases. Sinopharm recipients generally showed no symptom frequencies, followed by mild and moderate cases with rare severe symptoms. In contrast, unvaccinated individuals primarily exhibited moderate to severe symptoms, with fewer mild or asymptomatic cases.

Conclusions: The study suggests that COVID-19 vaccines are more effective at preventing severe disease outcomes, such as hospitalization and death, than mild or asymptomatic infections. In Iraq, Sinopharm and Pfizer vaccines were observed to be more effective in reducing severe COVID-19 cases and hospitalizations compared to the AstraZeneca vaccine and unvaccinated individuals.

Keywords: **Pfizer, AstraZeneca, Sinopharm, COVID-19 Vaccines**.

تقييم فعالية لقاحات فايزر وأسترازينيكا وسينوفارم ضد كوفيد-19 في العراق: دراسة مقطعية لفعالية اللقاح وشدة الأعراض

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الخلاصة:

استجابةً لجائحة كوفيد-19، كان التطوير السريع للقاحات التي تستهدف فايروس كورونا (Sars-(Cov-2 أمرًا محوريًا. تعمل هذه اللقاحات عن طريق تحفيزانتاج الأجسام المضادة ضد البروتين المكون لغلاف الفايروس. تقيم هذه الدراسة فعالية لقاحات كوفيد-19 المتوفرة في العراق، مما يساهم في تعزيز المعرفة بالصحة العامة في البلد

الطرق: تم إجراء تحليل مقطعي باستخدام 1,233 مشاركاً عراقياً تم تطعيمهم بأحد اللقاحات المتوفرة في العراق، بما في ذلك فايزر أو أسترازينيكا أو سينوفارم، وتعرضوا لعدوى كوفيد-19 بعد تحصينهم. تم إجراء معظم التقييم السريري لجميع المشاركين.

النتائج: أظهرت النتائج أن متلقي لقاح فايزر عانوا في الغالب من أعراض خفيفة لكوفيد-19، مع عدد أقل من الحالات ذات الأعراض المتوسطة أو الشديدة. في حين ان الأشخاص الذين تم تطعيمهم بـ AstraZeneca في الغالب عانوا عن أعراض خفيفة إلى متوسطة، مع عدد أقل من الحالات الشديدة أو بدون أعراض. بشكل عام، في حين لم يظهر على متلقي سينوفارم أية أعراض متكررة، تليها الحالات

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الخفيفة والمتوسطة، مع ندرة الأعراض الشديدة. في المقابل، أظهر الأفراد غير المطعمين في المقام الأول أعراضًا متوسطة إلى شديدة، مع عدد أقل من الحالات الخفيفة أو بدون أعراض.

الاستنتاجات: تشير الدراسة إلى أن لقاحات كوفيد-19 كان لها فعالية في الوقاية من نتائج المرض الشديدة، مثل دخول المستشفى والوفاة، مقارنة بمنع العدوى الخفيفة أو بدون أعراض. وفي العراق، لوحظ أن لقاحي سينوفارم وفايزر أكثر فعالية في الحد من حالات كوفيد-19 الشديدة وحالات العلاج في المستشفيات مقارنة بلقاح أسترازينيكا والأفراد غير المطعمين.

الكلمات المفتاحية: لقاحات فايزر ، أسترازينيكا، سينوفارم، كوفيد-19.

1. Introduction

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has profoundly impacted globally, leading to significant health, economic, and social challenges. The development of vaccines against COVID-19 has been a pivotal step in combating the pandemic. Various vaccines, including Pfizer-BioNTech, AstraZeneca, and Sinopharm, have received emergency use authorization and have been deployed worldwide [1]. These vaccines have shown varying degrees of effectiveness and have been the subject of extensive study and analysis. The severe acute respiratory syndrome coronavirus-2 virus has been the target of many vaccine designs, each with a unique mode of action. COVID-19 vaccines are designed to protect against SARS-CoV by targeting the virus's spike (S) protein [1], which mediates virus-cell fusion by binding to the ACE-2 receptor in host cells. Currently, the vaccination methods include mRNA, replication-incompetent vector, recombinant protein, and inactivated vaccines [2]. Booster doses are required to elicit both a B cell response leading to the generation of neutralizing and binding antibodies and a T cell response [3]. Currently, in Iraq, three types of vaccines have been massively applied: the BNT162b2 vaccine by Pfizer-BioNTech vaccine generated from engineered messenger RNA encoding the spike protein (S) of SARS-CoV-2, the Oxford AstraZeneca vaccine uses a modified chimpanzee DNA adenovirus and the CoronaVac vaccine from Sinovac, Sinopharm, China. that contains the inactivated SARS-CoV-2 virus [4]. In order to verify a vaccine's efficacy in preventing the pandemic illness, it is necessary to evaluate immune responses to vaccines using serological and/or immunological markers. COVID-19 is a severe sickness, yet there is no research on approved immunizations that have shown to be highly effective against it. The actual usefulness of authorized and licensed COVID-19 vaccines in managing this outbreak and the next is still unclear, and there are still significant barriers to achieving equal immunization access throughout the world. It was discovered that a two-dose regimen with a goal gap of three weeks between the vaccinations was very successful [5]. Different vaccine data show a longer dosage interval may provide better protection. According to a reanalysis of the BNT162b2 trial results, this vaccine is 92.6% effective after a single dose in the early post-vaccination interval [6]. An improved immune response to the booster dosage is also shown with other vaccinations when a more extended period is allowed between the prime and booster doses. The rising prevalence of COVID-19 in the UK and the need to quickly vaccinate as many susceptible individuals as possible. A policy decision was then taken to prioritize giving the first dosage of the vaccine to as many individuals as feasible [1]. Disease prevention is only one aspect of a vaccine's impact on a community; there are likely many others that have equal or greater weight. First, the effectiveness of vaccination on susceptibility suggests that a COVID-19 vaccine may lessen the chance of contracting SARS-CoV-2 following exposure. Subclinical infection with viral shedding that may still allow transmission might result from a vaccination, which may or may not lessen the chance of symptoms upon infection. Those fatalities would be critical, and the instances would help explain why. Finally, a vaccination has the potential to lessen the spread of infection among those who get it [7]. The population-level effect of vaccination is contingent on each of these factors. Moreover, the public tends to think that a vaccine's efficacy should be maximized, even though the point of vaccination is to lessen the likelihood of severe disease or death. The timing and location of clinical trials for vaccinations will have a knock-on effect on vaccine efficacy, but this in no way reflects the quality of the vaccine being tested [8]. There are limited

studies on the vaccine's efficacy on secondary COVID-19 infection symptoms, hospitalization, and mortality. This study aimed to evaluate the effectiveness of the vaccine in the reduction of COVID-19 variant symptoms and hospitalization. The limitation of this study is the lack of data regarding the prior COVID-19 infection status of the participants before vaccination. It is challenging to distinguish the effects of vaccine-induced immunity from natural immunity acquired through previous infection. This limitation may impact the accuracy and generalizability of the study's comparative effectiveness of the Pfizer, AstraZeneca, and Sinopharm vaccines in the Iraqi population.

2. Materials and Methods

2.1. Subjects and data collection

A cross-sectional study was conducted with the questionnaire data supplemented on 1233 cases vaccinated and infected with COVID-19 followed vaccination. The four groups were Pfizer vaccinated, AstraZeneca, Sinopharm, and non-vaccinated, and infected with COVID-19. Their ages were (30±5.4, 38±6.33, 46±6.1 and 51±7.3), respectively. The cases were performed on volunteers in Iraq. The inclusion criteria were individuals aged 18 and above, participants who received either Pfizer, AstraZeneca, or Sinopharm COVID-19 vaccines, individuals who contracted COVID-19 post-vaccination and unvaccinated individuals who contracted COVID-19. The exclusion criteria were those individuals below 18 years of age, participants with a history of severe allergic reactions to vaccines, individuals who received a COVID-19 vaccine other than Pfizer, AstraZeneca, or Sinopharm, as well as participants with immunocompromising conditions or on immunosuppressive therapy as well as chronic illness. The study was approved by the Ethics Committee of the College of Biotechnology, Al-Nahrain University. Consent was taken from all subjects for inclusion in the study. It's clear that all individuals were tested.

2.2. Statistical analysis

The software GRAPHPAD PRISM 8 was used to obtain the mean and SE, $P<0.05$ considered as significant differences.

3. Results

The study analyzed the severity of COVID-19 cases in Pfizer, AstraZeneca, Sinopharm vaccinates, and non-vaccinated patients. The total cases were classified into A-symptomatic (no clinical signs), mild cases, moderated cases, and severe cases. The results showed that the most frequent cases after receiving the Pfizer vaccine were mild (46.9%), followed by Asymptomatic (35.6%), moderate (14.8%), and severe (2.7%) symptoms in shallow frequency. In AstraZeneca vaccinates, most cases were mild (44.15%), followed by moderate (42.9%) and severe (8.4%), with fewer Asymptomatic (4.6%) cases. In Sinopharm vaccinates most secondary infected patients were Asymptomatic (60.4%), followed by mild (22.6%), moderate (13.2%), and (3.8%) in severe cases. Non-vaccinated patients showed higher frequency in moderate cases (37.5%), followed by severe cases (23.7%), (21.5%) in mild cases and (17.3%) in Asymptomatic cases. (Table 2) (Figure 1) (Figure 2).

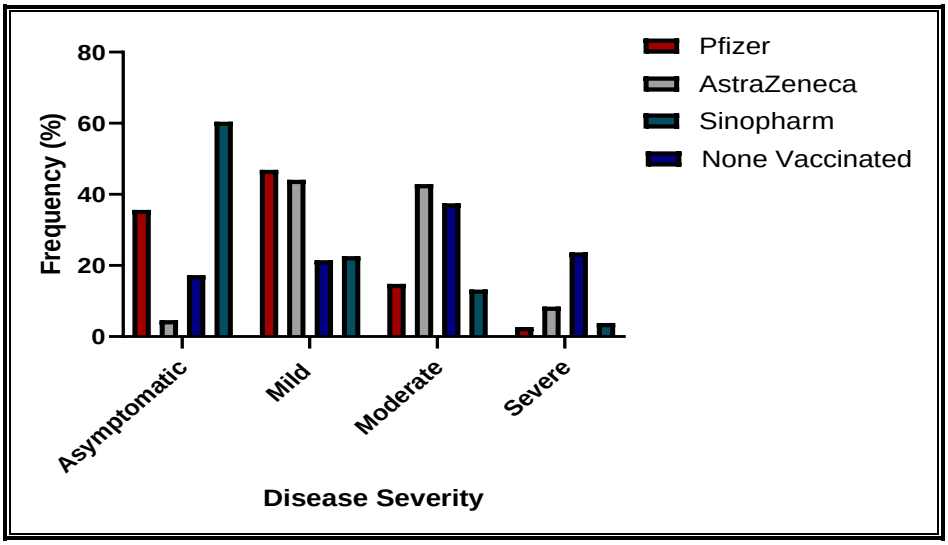

Figure (1): Distribution of vaccinated subjects according to the disease severity after infection with Covid-19

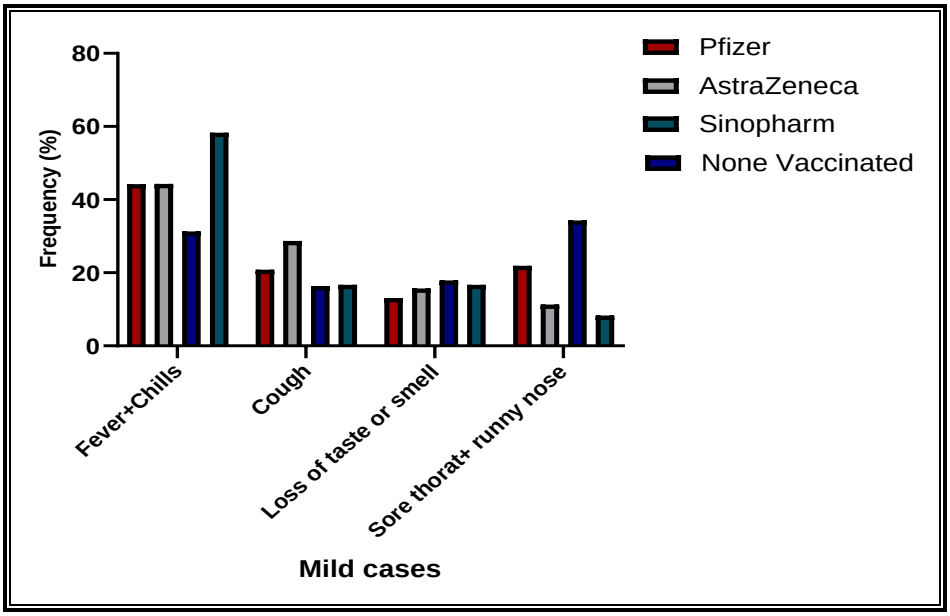

Figure (2): Distribution of mild subjects according to the disease severity after infection with Covid-19

Table 2: Distribution of vaccinated subjects according to the disease severity after infection with Covid-19

Groups	Asymptomatic N (%)	Mild Cases N (%)					Moderate	Severe	p. value
		Total Mild Cases	Fever+Chills	Cough	Loss of taste or smell	Sore thorat+ runny nose	Multi-Symtoms N (%)	ARDS to Sepsis N (%)	
Pfizer	197 (35.6)	260 (46.9)	115 (44.2)	54 (20.8)	34 (13.1)	57 (21.9)	82 (14.8)	15 (2.7)	0.001
AstraZeneca	12 (4.6)	115 (44.1)	51 (44.3)	33 (28.7)	18 (15.7)	13 (11.3)	112 (42.9)	22 (8.4)	0.06
Sinopharm	64 (60.4)	24 (22.6)	14 (58.3)	4 (16.7)	4 (16.7)	2 (8.3)	14 (13.2)	4 (3.8)	0.06
None Vaccinated	54 (17.3)	67 (21.5)	21 (31.3)	11 (16.4)	12 (17.9)	23 (34.3)	117 (37.5)	74 (23.7)	0.000

P. Value< 0.05, significant differences, N: numbers of cases,

4. Discussion

A total of 1233 data of follow-up vaccinated and infected clinical assessment after the emergence of SARS-CoV-2 and the three deployments of Covid-19 vaccines, we assessed the durability of protection against SARS-CoV-2 infection conferred by both infection-acquired and vaccine-acquired immunity. There is a significant difference in the risk of infection over an extended interval without vaccination [9].

Depending on the clinical assessment, it was noted that Pfizer-vaccinated individuals showed higher protection from developing coronavirus disease. Followed by Sinopharm vaccinates, where no differences were recorded between AstraZeneca vaccinated and non-vaccinated individuals [10], [11]. According to recent

research, vaccination has been demonstrated to provide longer-lasting protection against hospitalization and mortality than it does against symptomatic and asymptomatic illness. However, some studies have shown protection lasting anywhere from 5 to 12 months after infection, while others have claimed protection might extend up to 61 months. This is just speculation, however, due to the short follow-up periods in the research [12]. Protecting against life-threatening illness and death is the gold standard for vaccination effectiveness. SARS-CoV-2 can be mitigated with the help of an effective COVID-19 vaccination. To do so, we need to gather data on indicators of illness severity, such as hospitalization, the requirement for respiratory assistance, and intensive care unit (ICU) admission [13]. Anti-spike protein IgG titers at day 14 after the fourth dose were higher than those at day 28 after the third dose for both AstraZeneca and Pfizer vaccines, confirming our finding that COVID-19 Pfizer vaccines are well tolerated and can provide a substantial boost to both humoral and cellular immunity roughly seven months after a third-dose booster [14]. Similar results show that the amount of evidence available differs considerably amongst vaccines. The effectiveness of Pfizer vaccines against COVID-19 was >50% in phase III tests; they included AZD1222 and Ad26.COV2. S, Sputnik V, NVX-CoV2373, Ad5-nCoV, BBIBP-COrV, CoronaVac, COVAXIN, and the Wuhan inactivated vaccine. The Pfizer vaccines Sinopharm and AZD1222, which appear to be safe and very effective instruments to prevent severe illness, hospitalization, and mortality across all variations of concern, were evaluated in most observational studies (Alpha, Beta, Gamma, and Delta) [15]. Alpha, beta, and gamma Pfizer vaccines, as well as Sinopharm and AZD1222, provided excellent protection against both overt and latent infection. The Pfizer vaccines were linked to a decreased likelihood of viral culture positive and a quicker reduction in viral load against many variations, including Delta. After being infected with the Delta variety, your body's ability to fight against infections and COVID-19 gradually decreased over time [16]. A robust humoral response was elicited after receiving either a heterologous prime-boost immunization or a third dose of vaccine. The neutralizing response of previously infected individuals immunized with a single dose was comparable to that of individuals vaccinated with two doses against all the variations [17].

The quality of the data varies widely across vaccinations, but all appear to be safe and effective instruments for preventing severe COVID-19, hospitalization, and mortality against all varieties of concern [18]. Studies in the United States and the United Kingdom, however, indicated a lower incidence of BT infection with better vaccination efficacy (more than 90 per cent). The greater frequency of occurrence was variant-specific. Increased immune evasion following both spontaneous infection and vaccination has been linked to the presence of numerous mutations in the spike protein of the variations. Previous studies reported that a higher probability of protection against COVID-19 infection was seen for Pfizer vaccines (78%) compared to other vaccines. The AstraZeneca vaccination was the least effective against Break (BT), which supports the study findings. Moreover, it was reported that the AstraZeneca vaccination led to a greater rate of BT infection than the Pfizer vaccines. It is possible that the moderate number of BT infections in the Duhok governorate might be attributed to the widespread usage of the Pfizer vaccine [19]. Even among completely immunized people, the rate of COVID-19 BT infection was 25.5%. Consequently, COVID-19 breakthrough infections are effectively countered by the three currently available vaccine manufacturers, resulting in mild to moderate symptoms and a marked decrease in patients admitted to the intensive care unit [20]. In conclusion, our findings support the efficacy of Pfizer, Sinopharm, and AstraZeneca, respectively, in the reduction of hospitalization and mortality. Pfizer and Sinopharm showed higher effectiveness than AstraZeneca vaccines in the decrease of viral virulence.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions
Yasir W. Issa, Planning, sample collection, preparation, working procedures, data collection and analysis.
Shahlaa M Salih, experimental design, supervision, article writing.

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