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Protective effect of COVID-19 vaccination against a SARS-CoV-2 reinfection in the Babil Province

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Abstract

Reinfection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that causes coronavirus disease 2019 (COVID-19) has been documented all over the world. Currently, limited evidence exists concerning the protection afforded by the COVID-19 vaccination against reinfection with SARS-CoV-2. This case-control study was performed in order to assess the association between COVID-19 vaccination and SARS-CoV-2 reinfection in the Babil Province; the study used an electronic questionnaire. The infected patients were 115 (aged ≥18 years) and were confirmed by a positive PCR and/or a CT scan, they were either fully vaccinated or not with a second dose of a (Pfizer, AstraZeneca, or Sinopharm) vaccine before the reinfection date, and they were compared with 300 control participants. The study's findings revealed that the unvaccinated individuals had 4.5 times the odds of reinfection compared to those who were fully vaccinated, without preference for the manufacturer of the vaccine. The conclusion suggests that getting fully vaccinated against COVID-19 can significantly reduce the likelihood of reinfection, can enhance overall protection, and can minimize the risk of future infections.

KEYWORDS
COVID-19, SARS-CoV-2, fully vaccinated, reinfection, case-control study

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1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a pandemic viral disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 broke out in Wuhan, China, in December 2019 and spread worldwide with a very high mortality rate. Infection with SARS-CoV-2 not only leads to the development of severe acute respiratory syndrome, but progressively develops into a systemic disease with relevant extrapulmonary manifestations (that increase the lethality of

COVID-19) that include vascular, cardiac, renal, gastrointestinal, and central nervous system complications [1]. Pathophysiologically, the entry of SARS-CoV-2 at the cellular level is accompanied by widespread endothelial damage, while the altered immune response contributes to the multiple organ involvement seen in COVID-19 [2]. The first time a person is infected with COVID-19, it can take days or weeks to get over the infection. After the infection, the person's immune system remembers what it learned about how to protect the body against that disease. The immune system produces lymphocytes, called "memory cells", that act quickly if the body gets infected with the same virus again. B-lymphocytes produce antibodies to attack the COVID-19 virus again in reinfected cases.

Different types of vaccines work in different ways in order to offer protection. However, with all types of vaccines, the body will have memory lymphocytes as well as B-lymphocytes that will fight the virus and kill it in the future. It typically takes a few weeks after vaccination for the body to produce memory lymphocytes and B-lymphocytes [3]. Therefore, it is possible that a person could be infected with the virus that causes COVID-19 just before or just after vaccination and then manifest a symptomatic infection; this would be because the vaccine did not have enough time to provide protection. Sometimes after vaccination, the process of building immunity can cause symptoms, such as fever. These symptoms are normal and are signs that the body is building immunity [4]. This case-control study was undertaken in order to study the association between vaccination and SARS-CoV-2 reinfection in the Babil Province.

2. PATIENTS AND METHODS

This case-control evaluation was undertaken in order to study the association between COVID-19 vaccination and SARS-CoV-2 reinfection in the Babil Province between December 2021 and January 2022. The study was conducted among individuals previously infected with SARS-CoV-2 (n=115) and recruited control participants (n=300) for comparison. Our electronic questionnaire was filled by patients (aged ≥18 years) with a SARS-CoV-2 infection confirmed by positive polymerase chain reaction (PCR) and/or computerized tomography (CT) scan. Control participants were residents with confirmed SARS-CoV-2 infection who were not reinfected, while a "case-patient" was defined as a resident with a history of a confirmed SARS-CoV-2 infection and a subsequent reinfection.

The vaccination status was determined, and case-patients were considered fully vaccinated if a second dose of a (Pfizer, AstraZeneca, or Sinopharm) vaccine was received ≥14 days before the reinfection date. Partial vaccination was defined as the receipt of one or more dose(s) of the vaccine, but either the vaccination series was not completed or the final dose was received in less than 14 days before the case-patient's reinfection date. For the controls' vaccination status, the same definition was applied. Age, sex, and occupation were also considered in this study. Excluded subjects included only the individuals whose infection was not confirmed by a PCR or a CT scan.

3. RESULTS

This study details the findings of a case-control assessment of the association between CCOVID-19 vaccination and SARS-CoV-2 reinfection in the Babil Province between December 2021 and January 2022, among people previously infected with SARS-CoV-2. We have found that among the Babil Province residents who were previously infected with SARS-CoV-2, the young age group (between 20 and 40 years of age) was the target group of infection with a high percentage of reinfection among the medical staff (53%). Obviously, those who were unvaccinated against COVID-19 had a significantly higher likelihood of reinfection (82.6%), with a decrease of the susceptibility for infection in both partially or fully vaccinated subjects. Table 1 provides a detailed overview of the results obtained from our electronic questionnaire.

4. DISCUSSION

The findings of our study suggest that among previously infected individuals, full vaccination is associated with a reduced likelihood of reinfection and, conversely, being unvaccinated is associated with a higher likelihood of being reinfected. The lower odds of reinfection among the partially vaccinated group (as compared with the unvaccinated group) is suggestive of a protective effect, and is consistent with findings from previous studies indicating higher titers after the first mRNA vaccine dose in people who have been previously infected [5]. The immunity resulting from natural infection, although not well understood, is suspected to persist for ≥90 days in most people. However, the emergence of new variants might affect the duration of the infection-acquired immunity, and laboratory studies have shown that sera from previously infected individuals might offer weak or inconsistent responses against several variants of concern [6]. The patient's occupation might play a role in reinfection because there is a difference in the amount of vi-

ral exposure; in our study, we discovered that the medical staff had the highest ratio of case-patients when compared to other occupations, which was 53.91%. Therefore, the evaluation of infection rates and associated features is necessary in order to improve and adjust the protective measures of this vulnerable and highly essential group. On other hand, the same occupational group had the higher rate of infection control (42%); a fact that might be due to their knowledge about protection and could also be attributed to them receiving vaccines [8].

Table 1. Demographic and vaccination data for the case-patient and the control group.

General population questionnaire results					
Age (in years)					
	18–29	**30–39**	**40–49**	**50–59**	**60–69**
Case-patients (n=115)	79 (68.69%)	24 (20.86%)	7 (6.08%)	3 (2.6%)	2 (1.73%)
Control (n=300)	180 (60%)	70 (23.33%)	23 (7.66%)	22 (7.33%)	5 (1.66%)
Sex					
	Male		**Female**		
Case-patients (n=115)	98 (85.21%)		17 (14.78%)		
Control (n=300)	248 (82.66%)		52 (17.33%)		
Type of employment					
	Student	**Medical staff**	**Other employee**	**Unemployed**	**Earner**
Case-patients (n=115)	23 (20%)	62 (53.91%)	18 (20%)	10 (20%)	2 (1.73%)
Control (n=300)	64 (21.33%)	126 (42%)	74 (21.33%)	27 (21.33%)	9 (3%)
State of vaccination					
	Manufacturer		**Case-patients** (n=115)	**Control** (n=300)	
Not vaccinated			**95 (82.6%)**	**51 (17%)**	
Partially vaccinated	Pfizer		2 (1.74%)	20 (6.66%)	
	AstraZeneca		1 (0.87%)	4 (1.33%)	
	Sinopharm		1 (0.87%)	2 (0.67%)	
	Total		**4 (3.46%)**	**26 (8%)**	
Fully vaccinated	Pfizer		12 (10.43%)	183 (61%)	
	AstraZeneca		3 (2.06%)	33 (11%)	
	Sinopharm		2 (1.74%)	9 (3%)	
	Total		**17 (14.23%)**	**225 (75%)**	

Vaccine manufacturers might also play a minor role regarding the protection against COVID-19, but no strong evidence supports these data. Our study has found that 80% of the vaccinated patients have received a Pfizer vaccine, 15% were vaccinated with an AstraZeneca vaccine, and only 5% have received a Sinopharm vaccine. These data might be related to the availability and distribution of these vaccines in the Babil Province. These data also reflect that Pfizer has provided the highest protection among the three companies, since 93.8% of the patients who received a full Pfizer vaccination were found to be protected from reinfection, while 91.7% of the patients who received a full AstraZeneca vaccination were found to be protected from reinfection and 81.8% of the patients who have received a full Sinopharm vaccination were found to be protected from reinfection; however, the differences between the three manufacturers were not significant [9].

All eligible individuals should be offered a COVID-19 vaccination, including those with a previous SARS-CoV-2 infection. This will reduce their risk for future morbidity and mortality. Our findings suggest that among individuals with a previous SARS-CoV-2 infection, full vaccination provides additional protection against reinfection, while partial vaccination provides lower levels of

protection. Moreover, the Pfizer vaccines can provide a higher protection than those of other manufacturers.

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CONFLICT OF INTEREST STATEMENT
The authors declare no conflicts of interest.

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