https://doi.org/10.33472/AFJBS.6.8.2024.1978-1985 ISSN: 2663-2187

African Journal of Biological Sciences

Research Paper Open Access

The Impact of COVID-19Vaccination on Immunization of Vaccinated People in Jazan, Saudi Arabia

Dalin A. Hassan[1*], Amar B Elhussein[2], Omar E Fadlelseed[3], Anugeetha Thacheril Mohanan[4], Eman Merghani Ali[5], Maisa Yahya Almasrahi[6], Areej Mohammed Hakami[7], Shoaa Jaber Ali Mashyakhi[8], Samah Khudaysh Muqri[9], Roaa Hafiz Hamzi[10]

[1,4]Department of Pharmacology and Toxicology, College of Pharmacy, Jazan University, P.O. Box 114, Postal Code 45142, Jazan, Saudi Arabia.

[2]Department of biochemistry, Nile University, Sudan

[3]Department of biochemistry, Faculty of Medicine, Alzaeim Alazhari University, Sudan

[5,6,7,8,9,10]Clinical Pharmacy Department, College of Pharmacy, Jazan University

Corresponding author (*): Dalin A. Hassan
Email: dalinkareem@gmail.com

Article Info

Volume 6, Issue 8, April 2024
Received: 20 Feb 2024
Accepted: 13 March 2024
Published: 08 April 2024

Abstract

Background: COVID-19 causes severe respiratory illness, with more elderly patients and multi-morbid individuals being more vulnerable. The development of multiple COVID-19 vaccines has been crucial in combating the coronavirus pandemic that originated in 2019. Vaccinations are well recognized to impact the immune system. Despite an upsurge in coronavirus vaccine studies in recent years, the variance in immunity before and after COVID-19 vaccination has yet to be established. The study aimed to determine the differences in immunity before and after COVID-19 immunization among vaccinated persons in Jazan, Saudi Arabia. **Methodology:** A descriptive cross-sectional study using a self-completing anonymous questionnaire was conducted online using Google Forms among the of College of Pharmacy, Jazan University, Saudi Arabia interns. The questionnaire consisted of two parts: The first part described respondents' demographic details and the second part included questions about the variance in immunity among vaccinated persons before and after the COVID-19 vaccination. Data Analysis: The responses from Google Forms were entered into Microsoft Excel and analyzed for frequencies and percentages. **Results:** A total of 1001 volunteers agreed to take part in the survey. The participants' ages varied from 12 to over 50. Over 60% of the participants received three doses of COVID-19 vaccination, 28% received just two doses, a 5% received a single dose. Immunity was shown to be declining in 45% of the individuals. **Conclusion:** Research results indicate that immunity differs before and after the COVID-19 vaccination. The complexities of the immune responses to COVID-19 infection and immunization differed, despite being equivalent overall.

Key words: COVID-19, Immunity, Vaccine, Adverse Effect Following Immunization, Questionnaire Survey

Introduction

During the COVID-19 pandemic years, the scientific community worldwide, notably in health care and life sciences, noticed rapid transformations..(1) There are several clinical trials, observational research, and reviews on the pandemic. The coronavirus illness 2019 caused by severe acute respiratory syndrome (SARS CoV-2) is strongly linked to an individual's immune response. (2) People affected by the COVID-19 virus had severe respiratory disease, with elderly patients and those with several medical conditions being the most vulnerable. (3) In March 2020, the first incidence of COVID-19 in Saudi Arabia was recorded. By December 2020, the Kingdom had recorded a total of 358713 cases and 5965 fatalities. (4) The most common consequence observed was acute respiratory distress syndrome (ARDS), which arises as a result of COVID-associated pneumonia. The adaptive responses are activated shortly after innate immunity is activated, and the immunopathology of ARDS is interconnected with a complex array of numerous immunological actors functioning in a coordinated manner. (5, 6)

Vaccination is one of the most practical healthcare interventions for improving health outcomes and quality of life, along with boosting the equality of healthy life expectancy by preventing and managing infectious illnesses. Vaccination is the gold standard for developing immunity and disease prevention. (7, 8)

Vaccines' function as tried-and-true life-saving medications, as well as the usefulness of epidemiological principles in optimizing vaccination's advantages, are becoming more widely recognized. To discover antibody responses to vaccinations, "the correlates of protection," an immune response statistically correlated with protection and often linked to a B-cell-dependent response, are typically utilized. T-cells, on the other hand, are thought to contribute to correlates of protection for many new vaccinations. To figure out the correlates linked with protection, animal challenge models and effectiveness studies are used. (9) The connection between vaccination and immunity is widely recognized. Vaccinations are well recognized to impact the immune system. Following vaccination, one may expect either an immunological deficit or an increase in immunity.

During severe COVID-19, the progression of systemic inflammation results in a hyper-inflammatory state owing to cytokine release syndrome, and the spread of numerous new SARS-CoV-2 variations throughout the world diminishes the protective immune response to viruses generated by infection or vaccination. Concerns are growing to concentrate on the differences in immunity among vaccinated persons before and following COVID-19. (10). Individuals who have already overcome COVID-19 experienced improved immune responses following vaccinations (hybrid immunity). (11). However, the consequences of post-vaccination breakout infections on humoral immune response remain unspecified. Despite an upsurge in coronavirus vaccine studies in recent years, the variance in immunity before and after COVID-19 vaccination has yet to be established. (12) The current study's major objective was to determine differences in immunity before and after COVID-19 immunization among vaccinated people in Saudi Arabia. The immunological responses elicited by COVID-19 infection or vaccination likewise were investigated.

Materials and Methods

A descriptive cross-sectional study with a self-completing anonymous questionnaire was carried out via Google Forms among interns at Jazan University's College of Pharmacy in Saudi Arabia. The research period was extended from April 1st to May 15th, 2023. The survey form was issued in two parts: English and Arabic surveys. The first section provided respondents' demographic information, while the second section featured questions about the variance in immunity among vaccinated persons before and after the COVID-19 vaccination. Responses were gathered and recorded in English. To admit participants for the study, a simple random sampling procedure was used. After gathering replies using Google Forms, the data was analysed. The observed data were examined for baseline characteristics, and descriptive analysis was employed to express the demographic information in frequencies and percentages.

Results and Discussion

A total of 1001 interns decided to enrol and take part in the survey. The participants' ages ranged from 12 to over 50. Males (71.2%, n=713) outnumbered girls (28.8%, n=288) in the study. The age group distribution showed that over half of the participants (50%, n=500) were between the ages of 19 and 30, with 31.3% (n=323) being between the ages of 30 and 50, 11.9% (n=119) being between the ages of 12 and 18, and 5.8% (n=59) being above 50. The education level of participants revealed a significant number (67.8%, n=679) with university and above education, 26.7% (n=267) with high school education, 3.3% (n=37), and 2.2% (n=18) with middle school and primary school education, respectively. (Table 1)

Table 1: Demographic characteristics

Gender	**Number**	**Percentage %**
Male	713	71.2
Female	288	28.8
Age (Year)		
12-18	119	11.9
19-30	500	50
30-50	323	31.3
More than 50	59	5.8
Education level		
Primary school	18	2.2
Middle school	37	3.3
High school	267	26.7
University and above	679	67.8

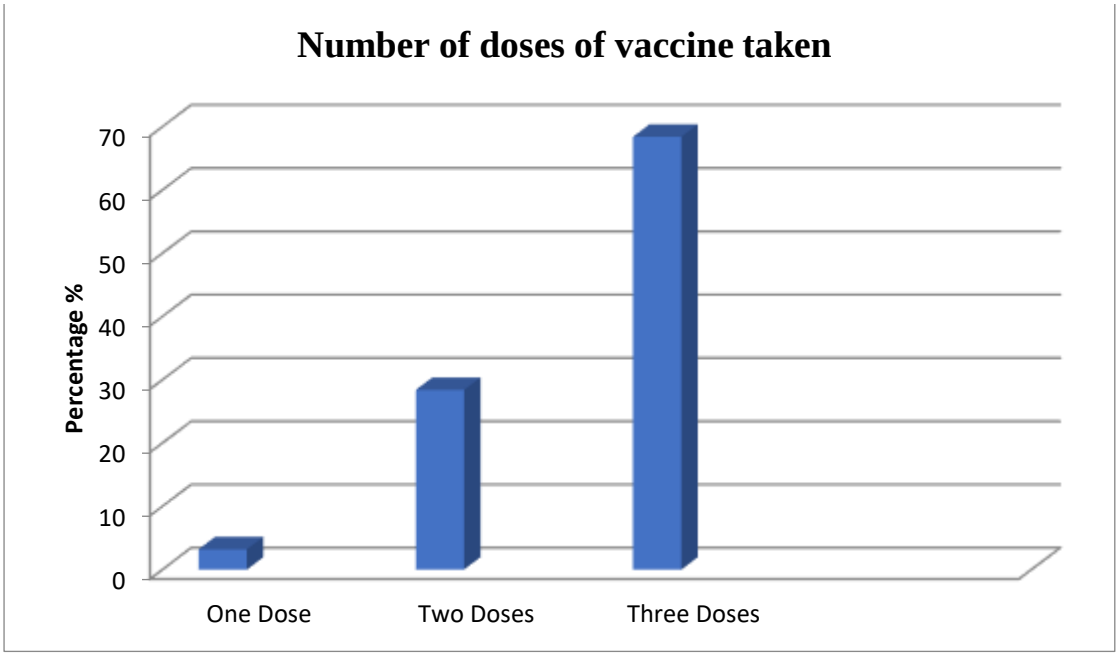
The participants received inquiries about their chronic morbidity status, where 82.2% had a chronic condition, whereas 17.8% did not. Among them, 53.2% (n=533) had COVID-19 infection and 38.6% (n=386) had COVID infection following vaccination. In contrast, 46.8% (n=469) of subjects did not show signs of COVID-19 infection, whereas 61.4% (n=614) were impacted following vaccination. (Table 2)

Table 2: Information related to vaccinated people

	Yes %	**No %**
Have a chronic disease	82.2	17.8
Have been infected by Covid-19	53.2	46.8
Have been affected by Covid-19 after vaccination	38.6	61.4

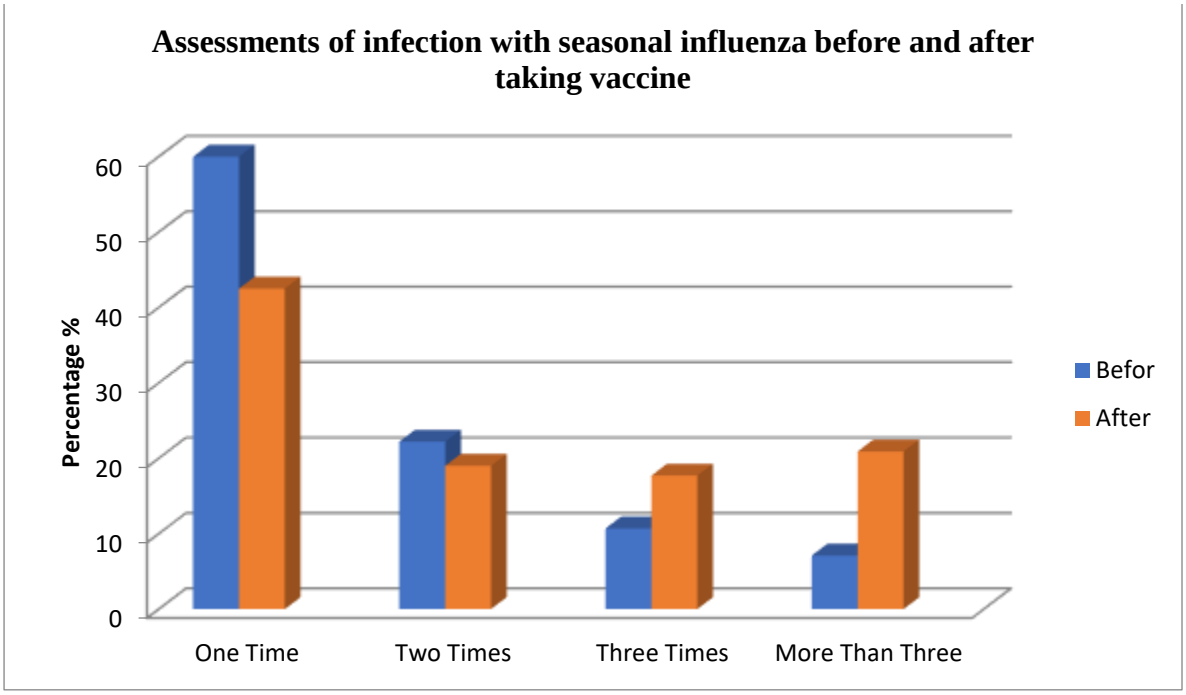
More than 60% of the participants were vaccinated with three doses, while 28% had only two doses and the least of them (5%) were vaccinated with a single dose of the vaccine. (Figure 1)

Fig.1: Number of doses of vaccine taken



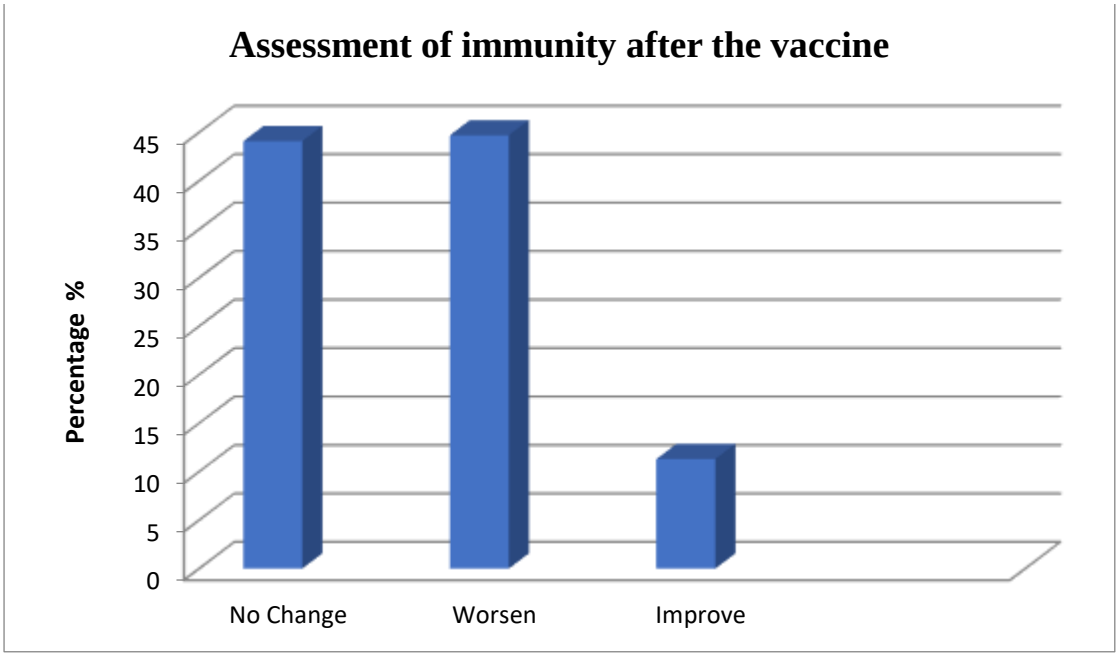
More than 50% of participants were presented with the incidence of seasonal influenza once before the vaccine and among them, nearly 40% had a recurrence of seasonal influenza once post-vaccination. Also, more than 20% of the subjects were affected twice with seasonal influenza before the vaccine, while the count declined to less than 20% after vaccination. A thrice incidence of seasonal influenza before vaccination was observed in less than 10% while more than 10% of them, post vaccinated experienced seasonal influenza three times. Surprisingly, nearly 20% of the subjects had seasonal influenza more than four times after vaccination, while the percentage of individuals with seasonal influenza more than four times before vaccination was less than 10. (Figure 2)

Figure 2: Assessments of infection with seasonal influenza before and after taking the vaccine



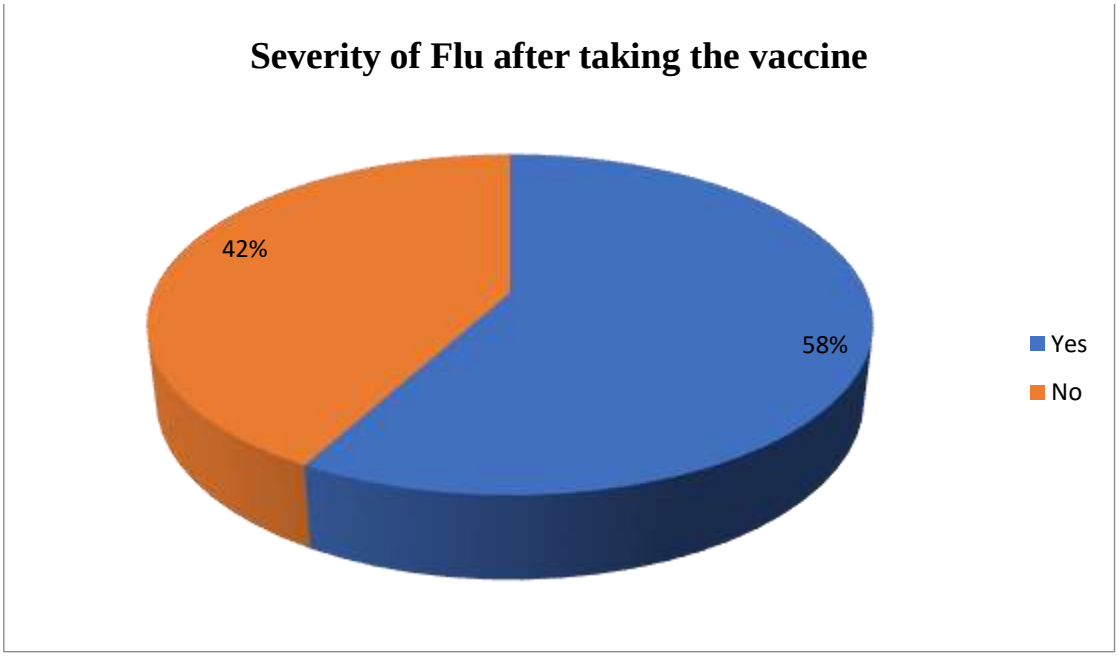
The responses on change in immunity after vaccination had no change as answered by nearly 45% of the participants and an equal number of individuals conveyed worsening of immunity. An improved immunity was represented by less than 10%. (Figure 3).

Fig.3 Shows the assessment of immunity after the vaccine



It was observed that 58% of the respondents agreed an enhanced severity of flu after taking the vaccine while 42% were not manifested with increase in severity of flu post vaccine administration. (Figure 4)

Fig4 Show severity of Flu after taking the vaccine



Discussion:

Several biological transformations occurred during the pandemic period. Variations in disease patterns, morbidity, and immunity were all shown to be significant. The occurrence of the sickness and the delivery of one to three doses of vaccination resulted in alterations in disease prognosis.

The current cross-sectional study was a fast assessment of the immune response of people of different ages, both before and after illness and vaccinations.

It appears that data collection using a web-based survey has the potential to generate information rapidly, cheaply, and efficiently.(13) The present study's respondents ranged in age from 12 to 50 years old, were of both genders and had various levels of education. The ease of diffusion of Google forms throughout diverse cohorts may have contributed to the research population's variability. As the participants' chronic morbidity status was checked, 82.2% of them had a history of a chronic disease, and there was a noticeable incidence of Covid 19 among them. Comprehensive stratified profiling of MM clusters in COVID-19 patients from the pandemic's initial wave revealed that patients with certain MM patterns, older adults, and men were more likely to die from COVID-19 infection or have severe illness. (14) Certain comorbidities might reduce a patient's resistance to organ damage or exacerbate these pathogenic pathways. (15) The multimorbidity index can assist in indicating who is more likely to struggle with severe COVID-19 outcomes and can help tailor an effective treatment approach.(16) More than 60% of the participants were vaccinated with three doses.

By of April 24, 2023, 68,534,631 vaccination doses were already delivered in the Kingdom of Saudi Arabia. (17) According to the study of Seyed M Moghadas et al, immunization reduced the total incident rate from 9.0% to 4.6% during 300 days. (18) Even though immunization only provides a limited amount of protection against infection, it can drastically minimize COVID-19 outbreaks. Non-pharmaceutical therapies must be used regularly to achieve this impact. The responders were infected with seasonal influenza on many occasions. Seasonal influenza incidence reflects a patient's immunological state. While there are considerable distinctions between COVID-19 and influenza, there are also numerous parallels, therefore doctors and epidemiologists must distinguish between the two as soon as possible. Indeed, many characteristics of the influenza and SARS-CoV-2 viruses are the same, including high incidence, rapid onset, and ease of mutation. It is crucial to recognize the possibility of concurrent infection with both conditions in addition to differentiating between the two. (19) Nearly half of the individuals reported a decrease in immunity following vaccination, highlighting the importance of the immunological state. Individuals who were completely immunized against COVID-19 may need a booster dose eight months later because immunological memory was preserved for up to eight months. Organ damage caused by SARS-CoV-2 elevates the likelihood of long-term health complications, which might result in challenges and aftereffects that need particular care. (20) The COVID-19 vaccination is one of the major risk factors for infections in critically ill patients. Eight months after receiving two doses of the COVID-19 vaccine, individuals who received the vaccination showed worse immune function than those who did not.(21)

Vaccines, regardless of different dosages, are effective against SARS-CoV-2 and can induce an immune response. To manufacture inactivated viral vaccines, scientists adopt the classic technique, which has resulted in the development of multiple commercial vaccines. To develop this type of vaccine, the virus is cultivated in cells for amplification and then inactivated using chemicals, UV radiation, or heating. As a result, the fully inactivated virus provides the immune system with access to a diverse antigenic repertoire, which may be useful if viral modifications produce immunological escape.(22) However, like with any exogenous substance, adverse consequences after vaccination (AEFI) cannot be ruled out.

The cross-sectional study among university students was capable of revealing significant information regarding the immune status of individuals post-vaccination. The prospective survey method assessed directly from the respondents of varying age groups remains the strength of the study. Yet, since the questionnaire comprised of closed-ended questions, individual variations in immunity, extent of morbidity, and quality of life could not be assessed. Response bias is inevitable in any questionnaire study.

Conclusion

The data show that immunity differs before and after the COVID-19 immunization. More than fifty percent of the participants had coronavirus infection, whereas the other half did not. The majority of respondents received three dosages. The degrees of infectiousness of respondents differed before and after the COVID-19 vaccine; the majority experienced mild to moderate symptoms after a single infection, while a smaller fraction had severe symptoms. The complexities of the immune responses to COVID-19 infection and immunization differ, although they are equivalent overall. Systemic inflammation is produced by an inappropriate innate immune response triggered by an overreaction of the immune system to the infection. The researchers believe that

this may raise the risk of recurrent infections in patients both during and immediately following a COVID-19 episode.

It is safer for people to take immunizations before developing a disease than after contracting one spontaneously. Vaccination protects against major disease and death. Variations in immunity before and after the COVID-19 vaccine are worth researching since this type of research can give insight into the optimal practices to follow to improve immunity post-vaccination; however, additional research is needed to reach this aim.

Abbreviations used:

SARS CoV-2: severe acute respiratory syndrome; ADR: adverse drug reactions, AEFI: adverse effects following immunizations,

References

Riccaboni M, Verginer L. The impact of the COVID-19 pandemic on scientific research in the life sciences. PLoS ONE. 2022 Feb 9;17(2): e0263001.

Bates TA, McBride SK, Leier HC, Guzman G, Lyski ZL, Schoen D, et al. Vaccination before or after SARS-CoV-2 infection leads to robust humoral response and antibodies that effectively neutralize variants. Sci Immunol. 2022 Feb 18;7(68): eabn8014.

Chowdhury MA, Hossain N, Kashem MA, Shahid MdA, Alam A. Immune response in COVID-19: A review. J Infect Public Health. 2020 Nov;13(11):1619–29.

Alsayer RM, Alsharif HM, Al Baadani AM, Kalam KA. Clinical and epidemiological characteristics of COVID-19 mortality in Saudi Arabia. Saudi Med J. 2021 Oct;42(10):1083–94.

Gibson PG, Qin L, Puah SH. COVID-19 acute respiratory distress syndrome (ARDS): clinical features and differences from typical pre-COVID-19 ARDS. Med J Aust. 2020 Jul;213(2):54-56.e1.

Wong JJM, Leong JY, Lee JH, Albani S, Yeo JG. Insights into the immuno-pathogenesis of acute respiratory distress syndrome. Ann Transl Med. 2019 Oct;7(19):504.

Gilboa M, Regev-Yochay G, Mandelboim M, Indenbaum V, Asraf K, Fluss R, et al. Durability of Immune Response After COVID-19 Booster Vaccination and Association With COVID-19 Omicron Infection. JAMA Netw Open. 2022 Sep 1;5(9):e2231778.

Kamińska D, Dęborska-Materkowska D, Kościelska-Kasprzak K, Mazanowska O, Remiorz A, Poznański P, et al. Immunity after COVID-19 Recovery and Vaccination: Similarities and Differences. Vaccines. 2022 Jul 3;10(7):1068.

Lahariya C. Vaccine epidemiology: A review. J Fam Med Prim Care. 2016;5(1):7–15.

Yamamoto K. Adverse effects of COVID-19 vaccines and measures to prevent them. Virol J. 2022 Jun 5;19(1):100.

Kim J, Seo H, Kim HW, Kim D, Kwon HJ, Kim YK. Effect of Previous COVID-19 Vaccination on Humoral Immunity 3 Months after SARS-CoV-2 Omicron Infection and Booster Effect of a Fourth COVID-19 Vaccination 2 Months after SARS-CoV-2 Omicron Infection. Viruses. 2022 Nov 6;14(11):2458.

Kurdee Z, Al-Shouli S, AlAfaleq N, Meo SA, Alshahrani A, Alshehri A, et al. Public Perception towards the COVID-19 Vaccine in Riyadh, Saudi Arabia. Vaccines. 2022 May 28;10(6):867.

Regmi PR, Waithaka E, Paudyal A, Simkhada P, van Teijlingen E. Guide to the design and application of online questionnaire surveys. Nepal J Epidemiol. 2016 Dec 31;6(4):640–4.

Lleal M, Corral-Vazquez C, Baré M, Comet R, Herranz S, Baigorri F, et al. Multimorbidity patterns in COVID-19 patients and their relationship with infection severity: MRisk-COVID study. PLOS ONE. 2023 Aug 31;18(8):e0290969.

Russell CD, Lone NI, Baillie JK. Comorbidities, multimorbidity and COVID-19. Nat Med. 2023 Feb;29(2):334–43.

Chudasama YV, Zaccardi F, Gillies CL, Razieh C, Yates T, Kloecker DE, et al. Patterns of multimorbidity and risk of severe SARS-CoV-2 infection: an observational study in the U.K. BMC Infect Dis. 2021 Sep 4;21(1):908.

Saudi Arabia: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data [Internet]. [cited 2023 Nov 7]. Available from: https://covid19.who.int

Moghadas SM, Vilches TN, Zhang K, Wells CR, Shoukat A, Singer BH, et al. The impact of vaccination on COVID-19 outbreaks in the United States. medRxiv. 2021 Jan 2;2020.11.27.20240051.

BAI Y, TAO X. Comparison of COVID-19 and influenza characteristics. J Zhejiang Univ Sci B. 2021 Feb 15;22(2):87–98.

Yao L, Lu L, Ma W. Immunopathological changes, complications, sequelae and immunological memory in COVID-19 patients. Heliyon. 2022 Apr 26;8(4):e09302.

Yamamoto K. Adverse effects of COVID-19 vaccines and measures to prevent them. Virol J. 2022 Jun 5;19:100.

Tiyo BT, Schmitz GJH, Ortega MM, da Silva LT, de Almeida A, Oshiro TM, et al. What Happens to the Immune System after Vaccination or Recovery from COVID-19? Life. 2021 Oct 29;11(11):1152