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Humoral and cellular responses elicited by COVID-19 Pfizer vaccine in vaccination groups

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ABSTRACT
The purpose of the study was to monitor the humoral and cell immune responses and to investigate the variation in the antibody of a group of people who were first given the Pfizer vaccine that was made available in Iraq. The study had thirty subjects who had their levels of IgG antibody, IFN-γ, and IL-6 tested both before and after receiving the Pfizer vaccine. Prior to vaccination, as well as 14, 21, 28, 30, and 90 days following the second dose of the Pfizer vaccine, blood samples were taken. A humoral response was produced by the Pfizer vaccine, and younger subjects had higher IgG antibody concentration levels than older ones. After vaccination, the level of IgG concentration started to decrease after 60 days, but it peaked between 28 and 60 days later. A strong cellular response was triggered by the Pfizer vaccine. The female immune response is higher than the male. In the female, the high concentration of IFN-γ reached 2750. 3 ±18 10.6 in 60 days, while in the male it was 2415.2 ±1620.2. In the males and females, the levels started to decline in 90 days, reaching 1609.8 ± 1405.5 and 1324.4 ± 1090.3, respectively. Females have a stronger immune response to IL-6 than males do. In females, the high concentration of IL-6 occurs in 60 days, reaching 2590.3 ± 14710.6, while in males, it was 2324.2 ±1620.2. The levels in both females and males begin to fall in 90 days, reaching 1409.7±2605.4 and 1324.5±1290.2, respectively.

I. INTRODUCTION

At the end of 2019, Wuhan, China, discovered the new coronavirus, SARS-CoV-2, which is the cause of COVID-19 infection. As of the writing of this paper, the WHO has documented 6.85 million deaths and over 758 million confirmed cases of the pandemic (1). One feature of the COVID-19 pandemic that warrants special attention is the swift manufacturing and dissemination of COVID-19 vaccinations. Since it became clear that SARS-CoV-2 vaccination is the most effective way to combat COVID-19 globally and maybe stop the epidemic, a huge vaccination effort was carried out all over the world (2). It is crucial to note, nevertheless, that little is known about the processes underlying the protective response brought on through various vaccination schedules(3), particularly as they relate to the CoronaVac vaccine—the first vaccination administered to the Brazilian population. The entire inactivated SARS-CoV-2 virus makes up CoronaVac Originally administered in two doses, the second dosage was administered approximately 28 days following the first dose. This vaccine is presently being produced under license from the Brazilian government of São Paulo. Strong antibody responses to COVID-19 have been reported to be elicited by CoronaVac, and this may contribute to a decrease in hospital admissions and COVID-19-related deaths (4). On the other hand, the antibody response brought on by two CoronaVac treatments gradually diminishes (5). Additionally, it has been shown that two doses of the CoronaVac vaccine might elicit a strong immune response, primarily from CD4+ T cells with a Th1 immune profile. The offer of a third dosage of the COVID-19 vaccine has been made because it was unclear if this cellular response would last over time. From this point on, it was feasible to enhance the evoked immune responses by administering a vaccine of a different kind than those previously received (7). In this regard, the Pfizer vaccine was among the immunizations that were accessible in Brazil for use as the third dosage for people who had previously received a COVID-19 vaccination exclusively through CoronaVac. Depending on such data, our goal in this case study is to learn more about the humoral as well as cellular responses of a cohort of associates at Hospital Israelita Albert Einstein in So Paulo, Brazil, who participated in a COVID-19 vaccination schedule that began with CoronaVac

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vaccination and continued with a booster dose of the Pfizer vaccine.

II. MATERIAL AND METHODS

Blood samples were collected from 30 people in Babylon – city who had received the Pfizer COVID vaccine. The participants' ages ranged from 21 to 50 years of both sexes made up the majority. All participant data, including sex, age, vaccine type, dose, and other details, was recorded in accordance with the questionnaire form. Using a sterile, disposable plastic syringe, 3 ml of blood samples were taken from each participant under aseptic conditions. The samples were then placed into serum separator tubes in order to separate the serum. After samples had been clotted for a period of 30 mins and centrifuged for 10 mins at 3000 rpm, the serum was recovered and stored at -80^{o}C until it was analyzed by using an ELISA kit (Biotek, USA)for measure The SARS-CoV-2IgG II Quant antibody tes and IL-6 and IFN-γ. The serum was after that transferred to 1.5 ml Eippendorfs. To avoid doing repeated cycles of freezing and thawing, all samples have been evaluated in a single test.

III. RESULTS

The results in this study include measuring the level concentration of immunoglobulin G before and after vaccination in different days, and higher antibody concentration in younger participants than older ones. The peak increase in IgG concentration occurs betweenthe28 days and 60 days after vaccination which reaches 2703.8±3201.9 and 2581. 9 ±21 06.2 respectively in the age group (21-30) year, but the level began to decline after 60 days which reached to1724.8± 1303.5(/ML). In the age group (31-40) year the high level reached 2491.3±5013.8 and 2296.2±1094.2 betweenthe28 days and 60 days after vaccination while and decreased after 60 days reaching to1523.4±1581.3(ml). In contrast with the age group (41-50) year the concentration betweenthe28 days and 60 days reached to1947.7±3101.2 and 2110.5±2103.1 respectively and lower than other younger age groups, and decreased to to1091.5± 1460.1 (ml) after 60 days as shown in table (1).

Table 1: Assessment of immunoglobulin G concentration in sera of Pfizer vaccination groups pre and after vaccination based on different days

Age groups (year)	N= 30	Pre-vaccine Mean ± SD)(	Post 2nd dose of Pfizer vaccineIgG (/ML)				
			14 day	21 day	28 day	60 day	90 day
21-30	10	0	1974.6±1250.4	2011.6±1410.8	2703.8±3201.9	2581. 9 ±21 06.2	1724.8±1303.5
31-40	10	0	1747.8±2328.2	2105.7±1150.8	2491.3±5013.8	2296.2±1094.2	1523.4±1581.3
41-50	10	0	1263.3±1127.2	1585.6±1071.4	1947.7±3101.2	2110.5±2103.1	1091.5± 1460.1
Total	30						

The result reflects that antibody production is higher in females than in males the higher concentration of IgG antibody occurs in 28 days after vaccination which reaches2915.7±4150.6 while in females the higher concentration occurs in 60 days which reaches2538.1±1337.2 as shown in table (2).

Table 2: Assessment of immunoglobulin G concentration in sera of Pfizer vaccination groups according to sex

sex	Pre-vaccine Mean ± SD)(	Post 2nd dose of Pfizer vaccineIgG (/ML)				
		14 day	21 day	28 day	60 day	90 day
Female	0	1957.6±1310.4	2418.6±1710.9	2915.7±4150.6	2741. 3 ±17 04.5	1609.8±1205.5
Male	0	1452.8±2070.1	1930.4±1041.6	2146.2±1060.4	2538.1±1337.2	1423.4±1240.2

The study also includes measuring the level concentration of IFN-γ in search of Pfizer vaccination groups. The immune responsein females is higher than in males the high concentration of IFN-γ in female occur in 60 days reaching2750. 3 ±18 10.6 while in males was 2415.2±1620.2and the level began to decrease in 90 days in females and males

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reached1609.8±1405.5 and 1324.4±1090.3 respectively Table (3).

Table3. Assessment of IFN-γ levels in serum of patient's papilloma virus infection in comparison of control groups.

sex	Pre-vaccine Mean ± SD)(	Post 2nd dose of Pfizer vaccineIFN-γ (/ML)				
		14 day	21 day	28 day	60 day	90 day
Female	0	1842.9±1711.2	1989.8±2411.7	2306.5±3050.6	2750. 3 ±1810.6	1609.8±1405.5
Male	0	1472.8±1150.1	1710.3±1041.6	2160.4±2510.4	2415.2±1620.2	1324.4±1090.3

The study also includes measuring the level concentration ofIL-6 in search of Pfizer vaccination groups. The immune response in females is higher than in males the high concentration of IL-6 in female occur in 60 days which reaches2590. 3 ±14710.6while in males was 2324.2±1620.2and the level began to decrease in 90 days in females and malesreached1409.7±2605.4and 1324.5±1290.2 respectively Table (4).

Table 4. Assessment ofIL-6 levels in serum of patients papilloma virus infection in comparison of control groups.

sex	Pre-vaccine Mean ± SD)(	Post 2nd dose of Pfizer vaccine(/ML)IL-6				
		14 day	21 day	28 day	60 day	90 day
Female	0	1540.4±1711.2	1819.6±2801.5	2246.5±2050.6	2590. 3 ±14710.6	1409.7±2605.4
Male	0	1432.2±1302.1	1614.4±1811.4	2040.1±1510.4	2324.2±1620.2	1324.5±1290.2

IV. DISCUSSION

Table 1 indicates that the Pfizer vaccine results in higher IgG concentrations. This finding is consistent with a prior study where the author claimed that the Pfizer vaccination results in higher antibody readings following the observation of a first dose (2, 9), as displayed in Table 3. Table 1 illustrates the observation of a higher antibody concentration in younger participants compared to older ones. The present study's findings are consistent with earlier studies, which demonstrated that S1 IgG levels brought on by the Pfizer vaccination decreased with age, peaking in individuals between the ages of 12 and 19 (10). In addition, a second study found that the older age group's geometric mean concentration of anti-spike IgG was consistently lower and decreased after the second vaccination. Moreover, anti-SARS-CoV-2 antibody levels are higher in elderly persons following vaccination, and they are significantly more likely to have insufficient or no humoral response to the vaccination (11). Pfizer was found to cause higher IgG concentrations in males compared to females. As Table 2 illustrates, no appreciable variations between the sexes have been found. Likewise, a prior study conducted by Sinopharm, AstraZeneca, and Pfizer revealed no statistically significant variations in IgG levels between vaccinated females and males across all vaccine types (2, 12).

Conversely, it has previously been noted that there is a considerable difference in IgG concentration between females and males. Following the Pfizer vaccine vaccination, females had a considerably higher anti-spike-RBD IgG response compared to males (13). The findings presented in this brief study show that a strong specific IFN-γ response was elicited through the first dose of the CoronaVac vaccine, which was followed by enhanced antibody responses that neutralized the antibodies and IgG response following the second dose of the vaccine (14). Despite the fact that all of such responses dropped out 90–180 days following vaccination, the Pfizer vaccine booster markedly improved the cellular as well as humoral responses in every participant (2, 15). Along with such outcomes, we were also able to show that the two volunteers who had the worst humoral responses (nonresponders) following their CoronaVac vaccination had a remarkable presence of senescent T cells, which was only seen in the pre-vaccination sample and was associated with a pro-inflammatory systemic status (16). Our results were consistent with the literature regarding the initial immune response (humoral and cellular) to CoronaVac vaccination in such case reports (17).

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The literature reported that in a population regarding healthy individuals, the vaccination's peak humoral response (IgG response as well as neutralizing antibodies) occurred 28 days following the second dose was administered (18).

It has been shown that ninety days following the second dose, there was a decrease in the humoral response. In terms of the cellular response, the authors reported that both 28 and 90 days following the vaccination, there was a greater number of IFN-γ-producing cells in response to recombinant S protein from SARS-CoV-2, even though there was a notable variation in such values amongst the volunteers at these time points, as this brief report (19) illustrates. In line with the previously published data, Zhao and associates (2022) showed that the peak IgG response and neutralizing antibodies have been attained 28 days following the second CoronaVac vaccination dose and that these levels gradually decreased until 12 weeks. Regarding the cellular response, there was a notable decrease in the quantity of particular IFN-γ-producing T cells after 6 and 12 months, but there was still a higher number 28 days and 3 months following the second CoronaVac dose (20). To further emphasize such findings, we also saw a strong and quick response to a particular IFN-γ generated following the first CoronaVac vaccination dose (21).

V. STATISTICAL ANALYSIS

Statistical analysis occurs by using SPSS version 21. Standard deviation, have been utilized for expressing quantitative data the Chi-square test was utilized to compare percentages of categorical variables. For the purpose of analyzing the relationship between the various study variables, every test had two sides. Statistical significance (S) is defined as $P < 0.05$, whereas non-significant (NS) is defined as $P \geq 0.05$.

VI. CONCLUSIONS

Pfizer vaccine recipients produce the highest antibody concentrations in comparison with other vaccine recipients; younger individuals (under 40 years old) had higher antibody concentrations compared to older individuals. Antibody production appears to be higher in males than females. Weeks following the Pfizer vaccination resulted in a considerable increase in IgG levels; the highest IgG concentration was reached between days 28 and 60, while the lowest concentration was reached after day 60.

REFERENCES

[1]. Hayder AM, Al-Mumin AS, Mousa MJ; Association of dental caries in the era of COVID-19 with the number of occluded coronary vessels: A non-traditional risk factor in patients with acute coronary syndrome. JEMTAC. **2023,** 3,8,1-7.

[2]. Amal T.A., Zainab A. A., Ali F.O., Hayder A. A., Amir S. A.; Prevalence of adverse effects from COVID-19 vaccine among Iraqi adults: A retrospective cross-sectional study. JEMTAC. **2022,** 3,6, 1-19.

[3]. World Health Organization. WHO Coronavirus (COVID-19) Dashboard; World Health Organization: Geneva, Switzerland, **2022.**

[4]. Hajir K. A., Karam A. A., Mustafa K.A.,, Hayder A. A. The Liver Function Abnormalities in COVID-19 Patients and Their Association with Age and Sex: A Cross-Sectional Study. **2023**. 77, 5, 453-458.

[5]. Lurie, N.; Saville, M.; Hatchett, R.; Halton, J. Developing COVID-19 Vaccines at Pandemic Speed. N. Engl. J. Med. **2020**, 382,1969–1973.

[6]. Zhang, J.; Zeng, H.; Gu, J.; Li, H.; Zheng, L.; Zou, Q. Progress and prospects on vaccine development against SARS-CoV-2.Vaccines **2020**, 8, 153.

[7]. Lu, L.; Mok, B.W.Y.; Chen, L.L.; Chan, J.M.C.; Tsang, O.T.Y.; Lam, B.H.S.; Chuang, V.W.M.; Chu, A.W.H.; Chan, W.M.; Ip, J.D.; et al.Neutralization of Severe Acute Respiratory Syndrome Coronavirus 2 Omicron variant by sera from BNT162b2 or CoronaVacVaccine Recipients. Clin. Infect. Dis. **2022**, 75, e822–e826.

[8]. Chen, Y.; Liu, Q.; Guo, D. Emerging coronaviruses: Genome structure, replication, and pathogenesis. J. Med. Virol. **2020**, 92,418–423.

[9]. Ranzani, O.T.; Hitchings, M.D.T.; Dorion, M.; D'Agostini, T.L.; de Paula, R.C.; de Paula, O.F.P.; Villela, E.F.D.M.; Torres, M.S.S.;de Oliveira, S.B.; Schulz, W.; et al. Effectiveness of the CoronaVac vaccine in older adults during a gamma variant associated Epidemic of COVID-19 in Brazil: Test negative case-control study. BMJ **2021**, 374, n2015.

[10]. Fonseca, M.H.G.; de Souza, T.F.G.; Araújo, F.M.C.; de Andrade, L.O.M. Dynamics of antibody response to CoronaVac vaccine. J. Med. Virol. **2022**, 94, 2139–2148.

[11]. Ortega, M.M.; da Silva, L.T.; Candido, E.D.; Zheng, Y.; Tiyo, B.T.; Ferreira, A.E.F.; Corrêa-Silva, S.; Scagion, G.P.; Leal, F.B.; Chalup, V.N.; et al. Salivary, serological, and cellular immune response to the CoronaVac vaccine in healthcare workers with or Without previous COVID-19. Sci. Rep. **2022**, 12, 10125.

[12]. Zahid MN, Moosa MS, Perna S, Bin Buti E. A Review on COVID-19 Vaccines: Stages of clinical trials, mode of actions, and efficacy. Arab J Basic Appl Sci 2021;28:225-33.

[13]. World Health Organization,WHO Coronavirus disease (COVID-19): Vaccines, 2021.

[14]. Garcia-Beltran WF, Lam EC, Astudillo MG, Yang D, Miller TE, Feldman J, et al. COVID-19-neutralizing antibodies predict disease. Severity and survival. Cell 2021;184:476-88.e11.

[15]. Etikan I. Sampling and sampling methods. BiomBiostat Int J 2017;5:215-7. [doi: 10.15406/bbij. 2017.05.00149].

[16]. Amodio E, Capra G, Casuccio A, Grazia S, Genovese D, Pizzo S, et al. Antibodies responses to SARS-CoV-2 in a large cohort of vaccinated Subjects and seropositive patients. Vaccines (Basel) 2021;9:714.

[17]. Eyre DW, Lumley SF, Wei J, Cox S, James T, Justice A, et al. Quantitative SARS-CoV-2 anti-spike responses to Pfizer-BioNTech And Oxford-AstraZeneca vaccines by previous infection status. Clin Microbiol Infect 2021;27:1516.e7-1516.e14.

[18]. Romero-Pinedo S, Quesada M, Horndler L, Álvarez-Fernández S, OlmoA, Abia D, et al. Vaccine type –Age- and past infection-dependence Of the humoral response to SARS-CoV-2 spike protein. Front Immunol 2022;13:809285.

[19]. Wei J, Pouwels KB, Stoesser N, Matthews PC, Diamond I, Studley R, et al. Antibody responses and correlates of protection in the general Population after two doses of the ChAdO×1 or BNT162b2 vaccines.Nat Med 2022;28:1072-82.

[20]. Ikezaki H, Nomura H, Shimono N. Dynamics of anti-spike IgG antibodylevel after the second BNT162b2 COVID-19 vaccination in health careworkers. J Infect Chemother2022;28:802-5.

[21]. Collier DA, Ferreira IA, Kotagiri P, Datir RP, Lim EY, Touizer E, et al.Age-related immune response heterogeneity to SARS-CoV-2 vaccine BNT162b2. Nature 2021;596:417-22

[22]. Fonseca MH, de Souza TF, de Carvalho Araújo FM, de Andrade LO. Dynamics of antibody response to coronavac vaccine. J Med Virol 2022;94:2139-48

[23]. 22- Ayam M. Salih. Study of some cytokine elevation during measles virus infection in children.Biochem. Cell. Arch. .2021;21(1).1601-1604