# Assessment of IgG Antibodies and T-Cell Immune Response Following Inoculation with Various SARS-CoV-2 Vaccines
# A Retrospective Cohort Analysis

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**The study underscores the importance of multiple vaccine doses and highlights the effectiveness of mRNA vaccines in generating a strong immune response against SARS-CoV-2**

## BACKGROUND

- Various vaccine types were developed and produced to contain the COVID-19 pandemic.
- The induction and speed of production of immune biomarkers specific to SARS-CoV-2 may vary depending on the type and number of vaccine doses received.
- **Objective**: to explore variations in SARS-CoV-2 anti-spike (anti-S), anti-nucleocapsid (anti-N), and neutralizing immunoglobulin G (IgG) antibodies, and T-cell response by type and number of SARS-CoV-2 vaccine doses received.

## METHODS

- **Study design:** Retrospective cohort study.
- **Sampling strategy**: Random sampling.
- **Study population and setting:** 952 SARS-CoV-2 seropositive workers were re-surveyed and retrospectively followed, in the Abu Dhabi Emirate.
- **Measurements and data source**: Self-administered questionnaire collected data on various sociodemographic and lifestyle factors.
- **Medical records:** Data on the history of exposure and vaccination against SARS-CoV-2, including the number and type of the vaccine doses received. Any vaccination that occurred on or after the study blood sampling was not counted.
- Nasopharyngeal swab was collected from each participant for SARS-CoV-2 testing using reverse transcription-polymerase chain reaction (RT-PCR).
- **Blood samples:** Whole blood and sera samples were collected. Whole blood samples were screened for T-cell response. Sera were screened for three humoral SARS-CoV-2 IgG immune biomarkers (anti-spike [anti-S], anti-nucleocapsid [anti-N], and neutralizing IgG antibodies).

## RESULTS

- The 952 male participants (mean age: 35.5 years ± 8.4 SD) were retrospectively followed up from the last vaccine dose received until blood collection for a mean follow up time of 89.2 days ± 54.5 SD.
- Before blood collection, majority of the 952 workers were fully vaccinated and boosted with one vaccine dose (75.2%) or primed with two vaccine doses (20.2%). Only 2.2% were fully vaccinated (boosted with two additional vaccine doses).
- Seropositivity to anti-S, anti-N, and neutralizing IgG antibodies was detected in 99.7%, 99.9%, and 99.3% of the participants, respectively.
- Most of the participants who had ≥ median concentration of anti-S (≥357.5 BAU/mL), anti-N (≥146.5 COI), and neutralizing (≥172.0 AU/mL) IgG antibodies were boosted with at least one booster dose (79.3%, 85.6%, and 77.7%, respectively).
- Of 925 participants, 38.2% had a T-cell response. Of the 353 participants who had a T-cell response, 79.0% were boosted with at least one dose.
- Adjusted association between various scenarios of vaccination status and having ≥ median concentration of the measured immunoglobulins and T-cell reactivity presented in Table 1.
- T-cell reactivity by type and number of vaccine doses presented in Figure 1 A and B.

## CONCLUSIONS

- Maintaining elevated levels of protective immune biomarkers in the bloodstream is essential for assessing vaccine effectiveness, controlling transmission, and preventing outbreaks.
- In this study, boosting with only one dose or with only BBIBP-CorV after priming with BBIBP-CorV was insufficient to achieve high biomarker levels.
- Boosting with two doses, particularly with an mRNA-based vaccine, was associated with (1) high concentrations of anti-S, anti-N, and neutralizing IgG antibodies, and (2) an efficient T-cell response.

**Table 1.** adjusted association between history of vaccination and having ≥ median concentration of SARS-CoV-2 anti-S IgG, anti-N IgG, neutralizing IgG antibodies and having a T-cell response.

| Vaccination status | Anti-S IgG Abs (≥ median concentration) | Anti-N IgG Abs (≥ median concentration) | Neutralizing IgG Abs (≥ median concentration) | T-cell response (Yes vs. No) |
|---|---|---|---|---|
| | **aOR** (95% CI) | | | |
| **Every additional one vaccine dose** | **1.34** (1.02–1.76)* | **1.35** (1.03–1.75)* | **1.29** (1.00–1.66)* | **1.48** (1.12–1.95)** |
| **Booster status – vs not boosted** (primed with only two doses) | | | | |
| Boosted once (received three doses) | 0.90 (0.65–1.25) | **2.17** (1.54–3.1)*** | 0.78 (0.56–1.09) | 1.07 (0.76–1.51) |
| Boosted twice (received four doses) | 14.20 (1.85–109.4)* | 1.27 (0.48–3.36) | **13.60** (1.77–104.3)* | **7.62** (2.1–27.87)** |
| **Booster status - boosted** | | | | |
| Boosted twice (four doses) vs Boosted once (three doses) | **13.8** (1.78–106.54)* | 0.41 (0.16–1.08) | **13.18** (1.71–101.9)* | **7.22** (2.0–26.25)** |
| **Vaccine type–only vaccinated** | | | | |
| **BBIBP-CorV only** | 1.00 | 1.00 | 1.00 | 1.00 |
| Primed with BBIBP-CorV boosted with BNT162b2 | **7.57** (2.61–21.94)*** | 0.48 (0.23–1.0) | **7.86** (2.71–22.83)*** | **4.28** (1.93–9.50)*** |
| **Vaccine type–only boosted[1]** | | | | |
| Primed and boosted with BBIBP-CorV (n = 704) | 1.00 | 1.00 | 1.00 | 1.00 |
| Primed with BBIBP-CorV boosted with BNT162b2 | All the 29 were with ≥ median concentration | – | All the 29 were with ≥ median concentration | 14.63 (1.78–120.5)* |

Adjusted odds ratio for age (continuous), BMI (continuous), type of vaccine (except for only-BBIBP-CorV–vaccinated), smoking status, chronic comorbidity, the time duration since the last vaccine dose, and history of previous infection (PCR+).*** P < 0.001, ** P = 0.002, * P < 0.005

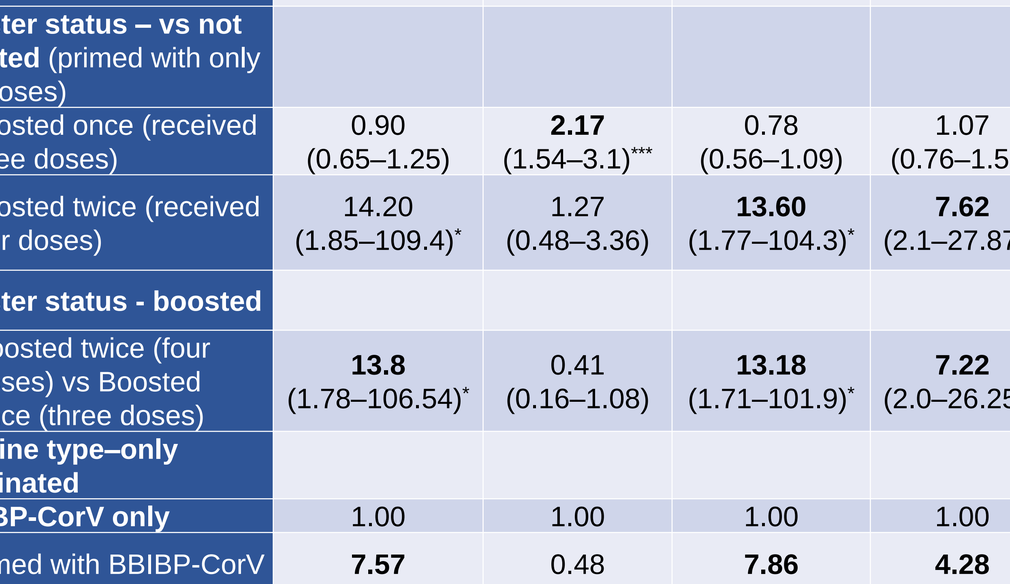


**Figure 1.** Proportion of participants with T-cells reactivity by (A) type and (B) number of of the received anti-SARS-CoV-2 vaccine doses regardless of the number of doses.

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