Assessing the Ability of COVID-19 Vaccines to Elicit Antibodies Against SARS-CoV-2 Variants of Concern

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BACKGROUND

The rapid spread of SARS-CoV-2 variants raises questions about the effectiveness of current COVID-19 vaccines. Here, we measured the ability of the vaccine-induced immune response to recognize the original (Wuhan) strain as well as the alpha, beta, gamma, delta and omicron variants of concern as well as the durability of this response.

METHODS

1. Collected plasma samples from 135 participants, one and six month(s) after their second vaccine dose and one month after their third vaccine dose
2. These samples were then put through two assays that are commercially available from MesoScale Diagnostics (MSD). One measures the ability of antibodies to bind to the viral Spike protein (of each variant) and the second measures how well these antibodies block the interaction with the cell entry receptor, Angiotensin Converting Enzyme 2 (ACE-2).

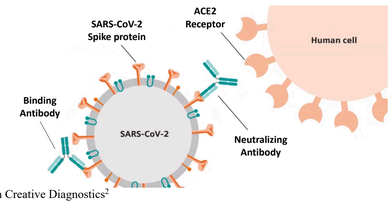


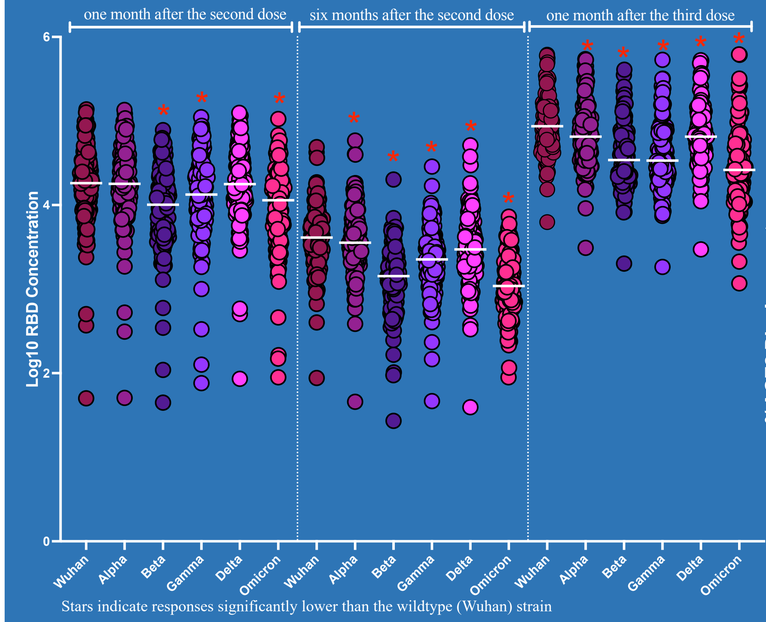
Figure from Creative Diagnostics[2]

DISCUSSION

- The results show that COVID-19 vaccines induced antibodies against all VoCs.
- The worst responses were observed in beta, gamma and omicron variants suggesting that they have some immune evasive mutations.
- Antibody responses declined significantly by six months after the second dose, but they were boosted to new peaks by a third dose.

COVID-19 vaccines are **successful in generating binding and neutralizing antibodies against all variants of concern**, although the responses of some variants are significantly lower than wildtype. The booster dose also aids in increasing all responses significantly to new peaks.

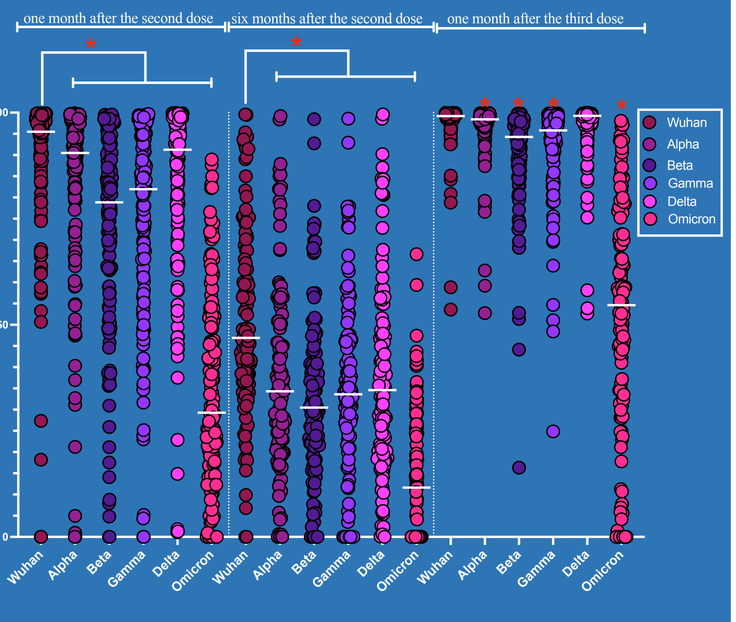
Binding Antibody Concentration



Stars indicate responses significantly lower than the wildtype (Wuhan) strain

- One month after the second vaccine dose, binding antibodies were similar against Wuhan, alpha and delta, but lower against beta, gamma and omicron (all $p<0.0001$).
- Six months after the second dose, binding antibodies declined against all strains, and were significantly lower from Wuhan against all variants except alpha.

%ACE-2 Receptor Blocking

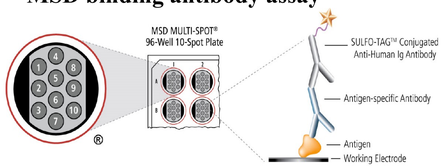


- One month after the third dose, binding antibodies against all strains exceeded prior peaks, but all remained significantly lower than wildtype.
- ACE-2 blocking activity was lower against all VoCs at all time points, the exception being delta at one month after the third dose.

Cohort Description:

- Age range of participants is from 24-98 years
- Participants are from long term care facilities and include seniors from the community (36), long term care residents (18) and health care workers (81)
- When separated into health care workers and long-term care residents, we see that older age is associated with lower responses up until one month after the third dose where this difference becomes insignificant.[1]

MSD binding antibody assay



Variants of Concern	Mutations in RBD	Date of Designation
Alpha (B.1.1.7)	N501Y	18-Dec-2020
Beta (B.1.351)	N501Y, K417N, E484K	18-Dec-2020
Gamma (P.1)	N501Y, K417T, E484K	11-Jan-2021
Delta (B.1.617.2)	T478K, L452R	11-May-2021
Omicron (B.1.1.529)	E484A, S477N, **T478K, K417N, N501Y**,…	26-Nov-2021

REFERENCES

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2. *SARS-COV-2 neutralizing antibody Elisa Kit*. Creative Diagnostics. (n.d.). Retrieved March 8, 2022, from https://www.creative-diagnostics.com/news-sars-cov-2-neutralizing-antibody-elisa-kit-107

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