Analysis of antibody levels after SARS-CoV-2 infection and/or COVID-19 vaccination in the population of Greater Poland (Wielkopolska) in 2020-2022

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Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) causing the COVID-19 disease was first identified in December 2019. Since the beginning of the COVID-19 pandemic in March 2020, various measures have been taken to protect against SARS-CoV-2 infection, including the extremely rapid development and introduction of effective vaccines. Although the COVID-19 pandemic was declared over in May 2023, the constantly mutating SARS-CoV-2 still poses a serious threat to human health, and many aspects of immunity against this virus remain unknown.

This doctoral thesis aims to study the immune response to SARS-CoV-2 infection and/or vaccination against COVID-19. In this research, levels of antibodies against SARS-CoV-2 were determined in the population of Poznań and Greater Poland province at different time points in 2020-2022.

It was shown that the SARS-CoV-2 seroprevalence in the general population of Poznań after the first wave of the COVID-19 pandemic was 0.93%, and the most vulnerable to infection were the elderly, those in frequent contact with other people, and those who did not comply with epidemiological recommendations. Asymptomatic SARS-CoV-2 infection was reported in about one-third of those with antibodies against SARS-CoV-2. Subsequently, it was proven that the levels of antibodies after SARS-CoV-2 infection correlate with the course of the disease and are higher the more severe the course of COVID-19. Similarly, higher levels of postvaccination antibodies were observed in those with a more severe course of the disease than in vaccinated individuals who had previously undergone asymptomatic SARS-CoV-2 infection. It was also found that the level of antibodies produced in response to the mRNA vaccine is higher than that to the vector vaccine, but it declines more rapidly. The titer of antibodies produced after receiving two doses of the vaccine and/or having SARS-CoV-2 infection decreases significantly within seven months, in some cases even below the detection threshold. Receipt of subsequent vaccine doses increases antibody levels. Regardless of antibody titers, vaccination provided protection against new cases of infection during the displacement of the Alpha by the Delta variant. However, after peaks of the Delta and the Omicron variant waves, more frequent cases of SARS-CoV-2 infection were found, regardless of the number of vaccine doses received.

The results of the antibody levels analysis presented here contribute to a better understanding of the immune response after SARS-CoV-2 infection and/or COVID-19 vaccination. Thereby, they provide information of use for developing strategies for the prevention and control of SARS-CoV-2 infection, with a special focus on vaccination policies.