HUMORAL AND CELLULAR IMMUNE RESPONSE INDUCED BY NOVEL SARS-COV-2 VACCINES

Szabina Erdő-Bonyár

Department of Immunology and Biotechnology, Clinical Center, University of Pécs Medical School

Pécs, Hungary

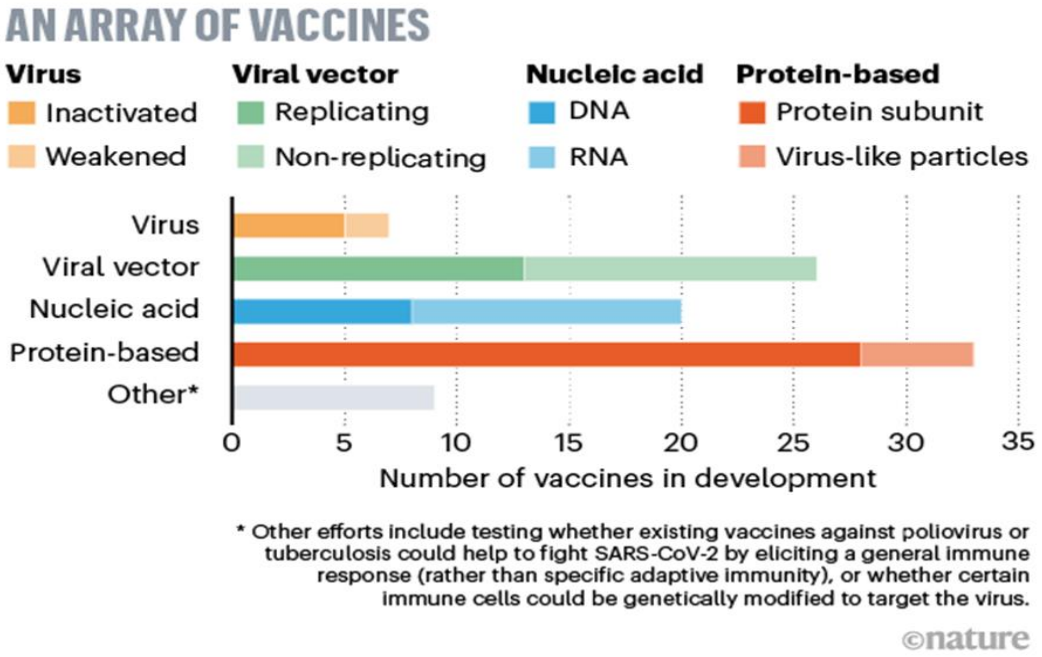
Visegrad Group Academies Forum
26 May, 2022
Budapest

NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE HUNGARY

PROGRAM FINANCED FROM THE NRDI FUND

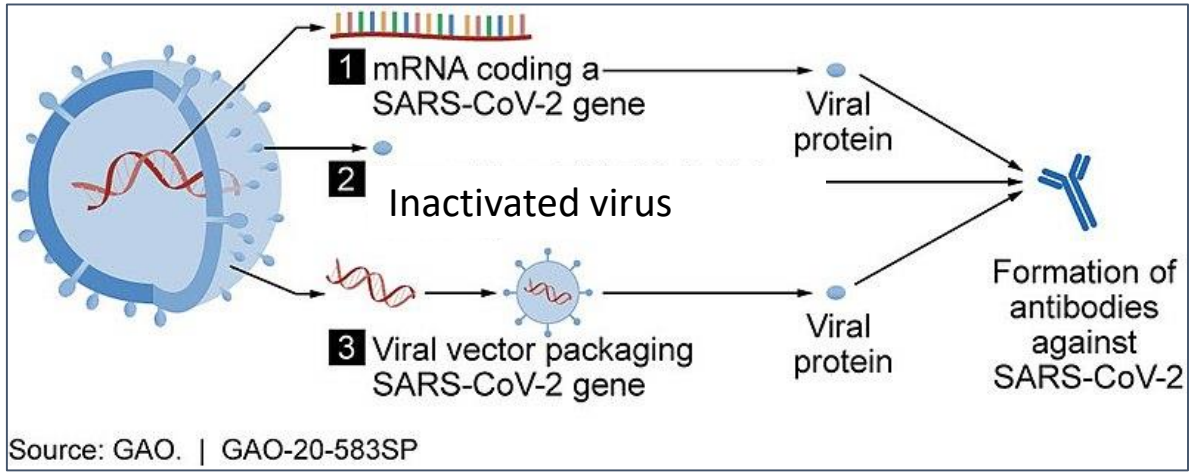
Background – COVID pandemic

- Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2)
- 2020- global public health crisis
- Respiratory symptoms, multi-organ manifestations
- No effective treatment
- Vaccine development – different platforms

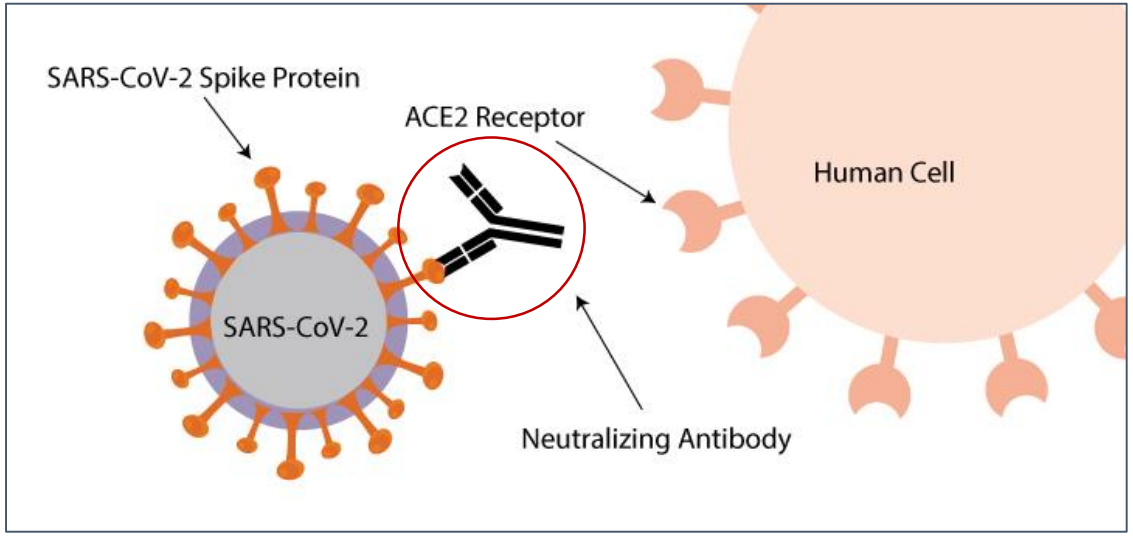


COVID-19 vaccines used in Hungary

- Inactivated → whole virus
- mRNA and vector → spike protein



- Spike protein binds to ACE2 receptor on the target cells
- Neutralizing antibodies are directed against Spike1 protein RBD

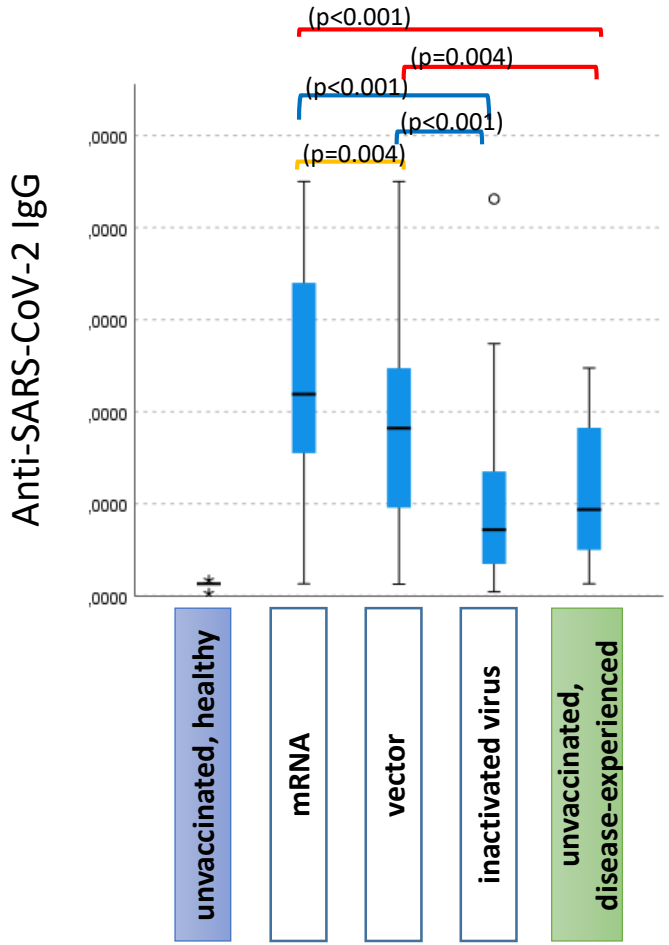


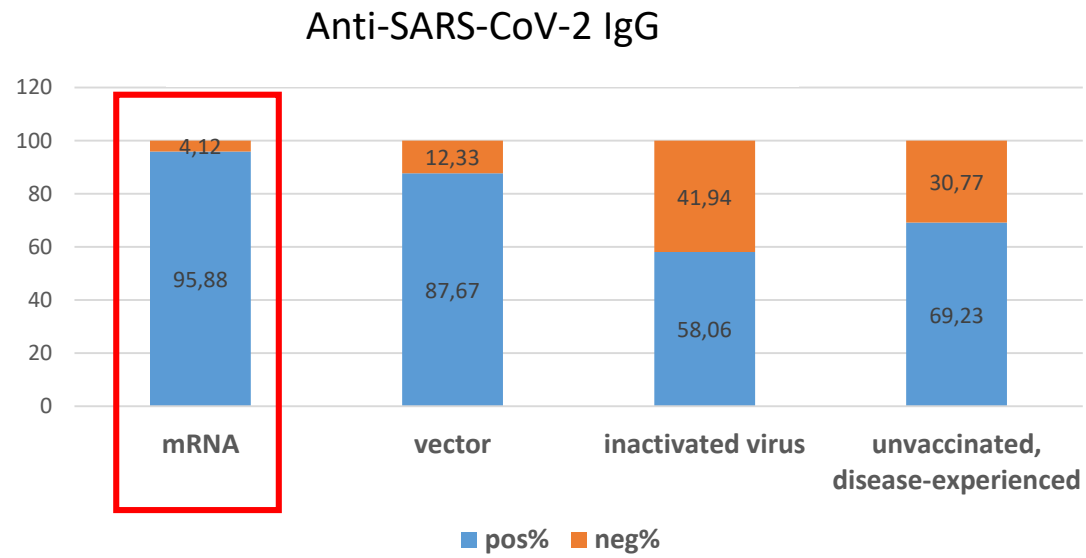
Investigation of the immune response after vaccination

Investigated groups	Number of collected samples
mRNA-based vaccine (Pfizer-Biontech)	106
vector vaccines (AstraZeneca, Sputnik V)	77
inactivated virus vaccine (Sinopharm)	34
unvaccinated healthy	9
unvaccinated PCR-confirmed disease-experienced	29
TOTAL	255

Peripheral blood samples were taken 2-3 months after second vaccination/infection

Measurement of the IgG antibodies directed against the spike protein of SARS-CoV-2

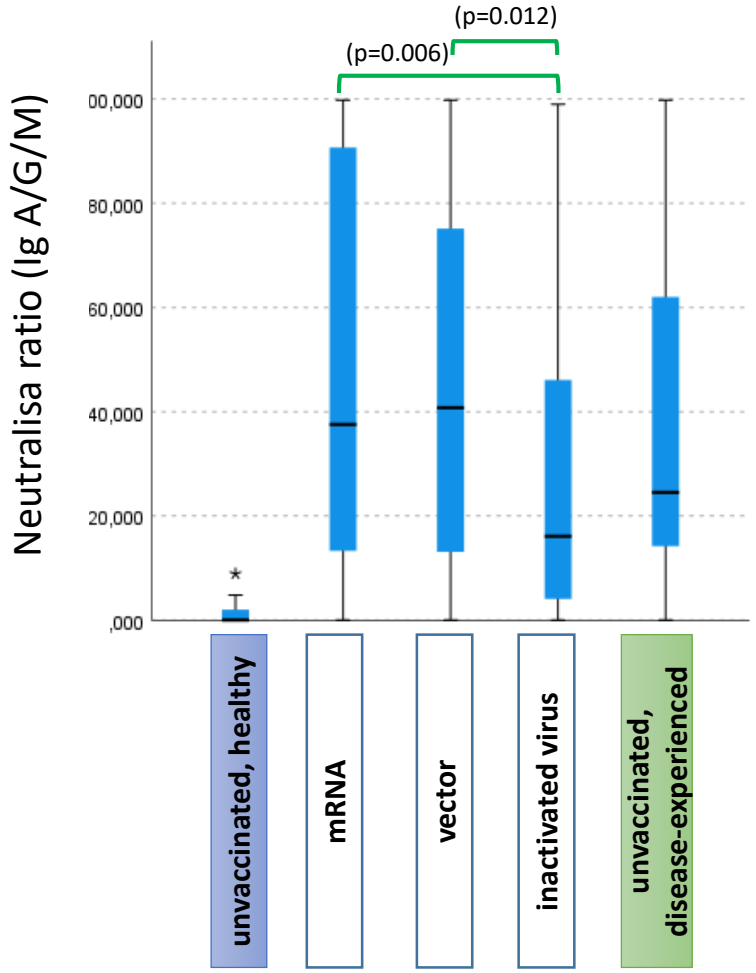


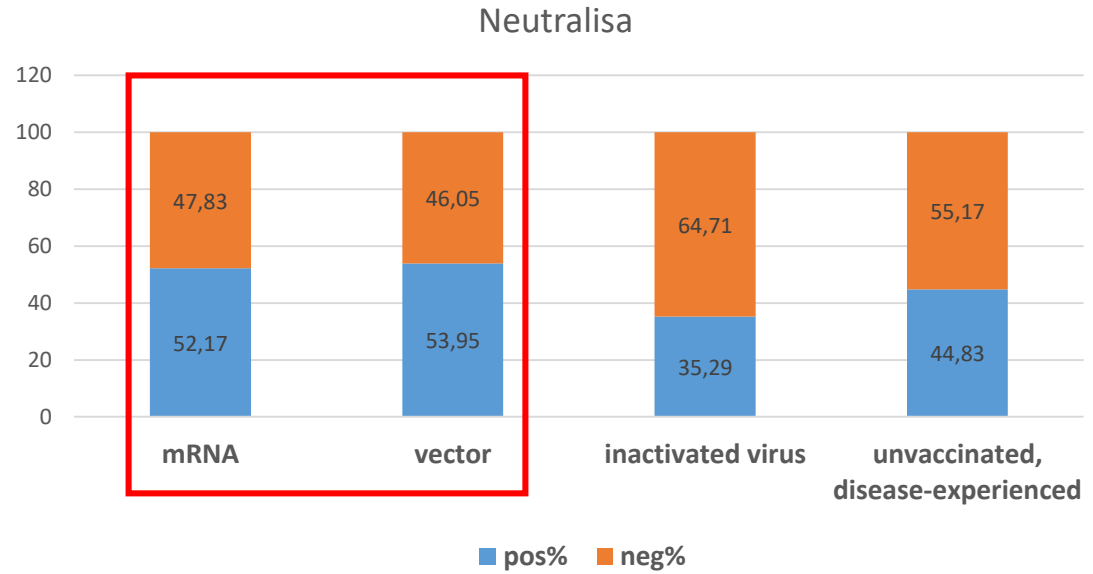


The mRNA vaccine induced the highest anti-SARS-CoV-2 S1 IgG antibody production

Anti-SARS-CoV-2 S1 IgG antibody Euroimmun ELISA

Examination of the neutralizing antibody against SARS-CoV-2 spike protein

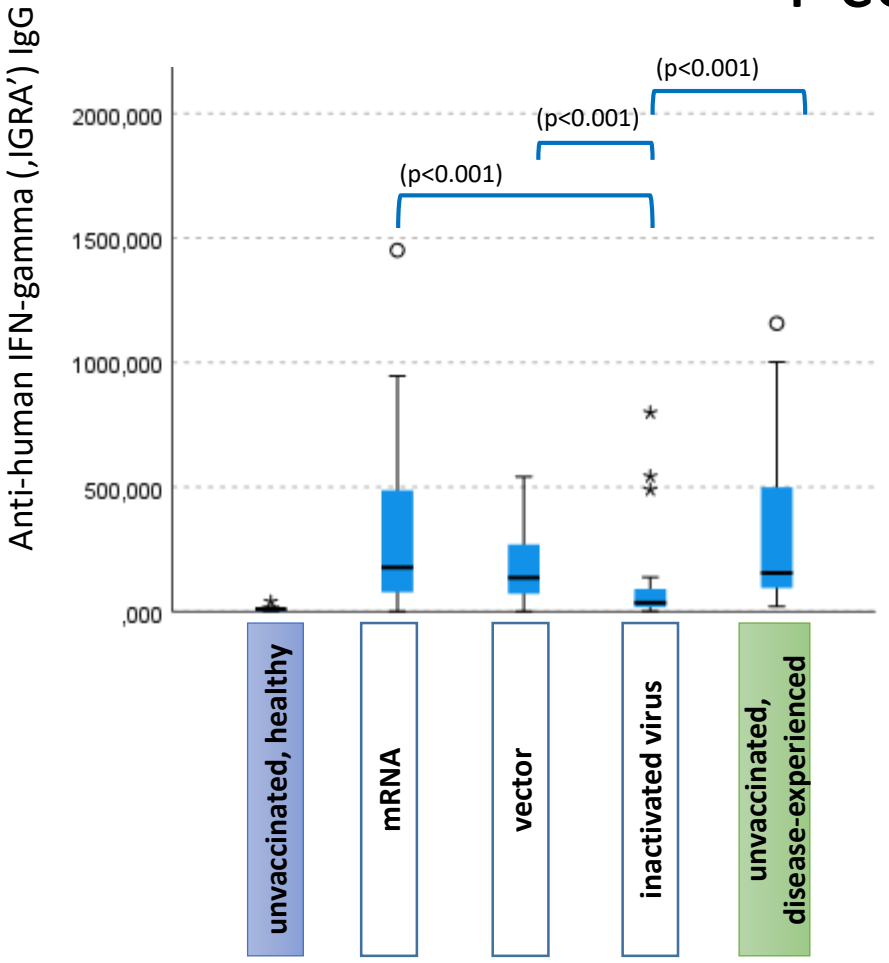


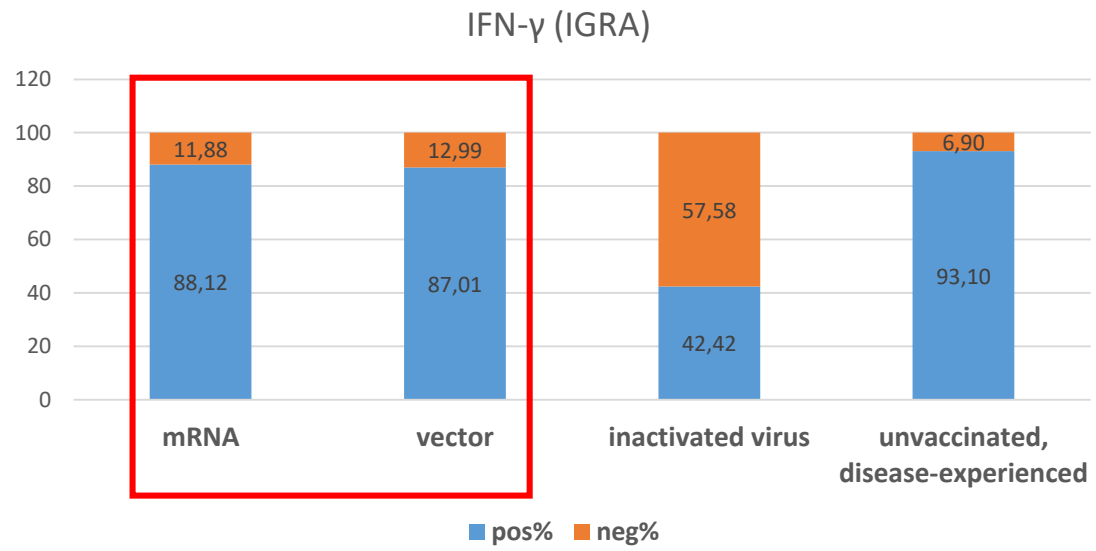


The mRNA and vector vaccine groups had the highest amount of neutralizing antibody

NeutraLISA –ACE2 receptor S1 RBD inhibition assay (Euroimmun)

Investigation of the SARS-CoV-2 S1 protein specific T cell immune response





The mRNA and vector vaccines induced as high IFN-gamma production as the natural infection

SARS-CoV-2 S1 protein specific T cell IFN-gamma release assay (IGRA) (Euroimmun)

Conclusion I.

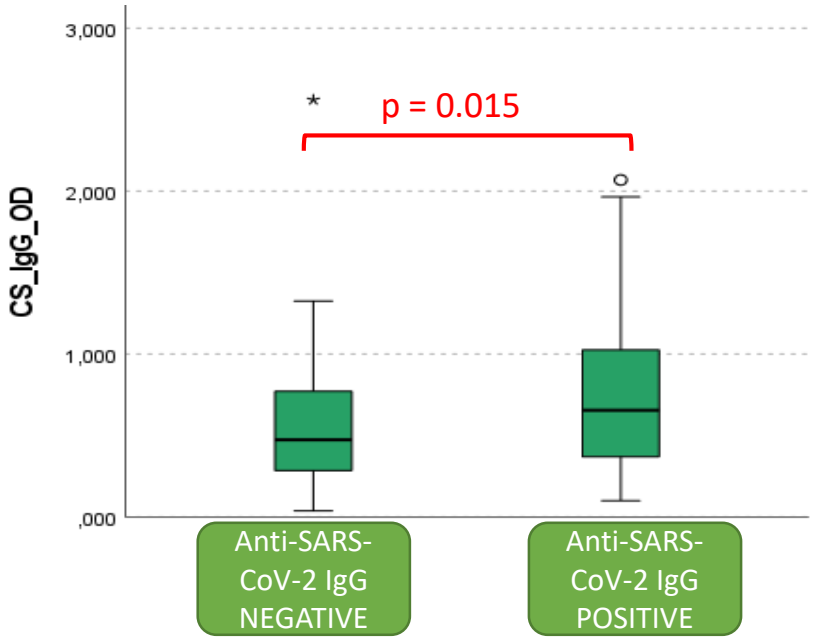
- The mRNA-based vaccine induced the highest anti-SARS-CoV-2 antibody level
- The mRNA and vector vaccines showed similarly good results in the cellular response and neutralizing antibody production
- Lower effectiveness of the inactivated virus vaccine may be due to the vaccine components and older age of the recipients

Background – natural autoantibody

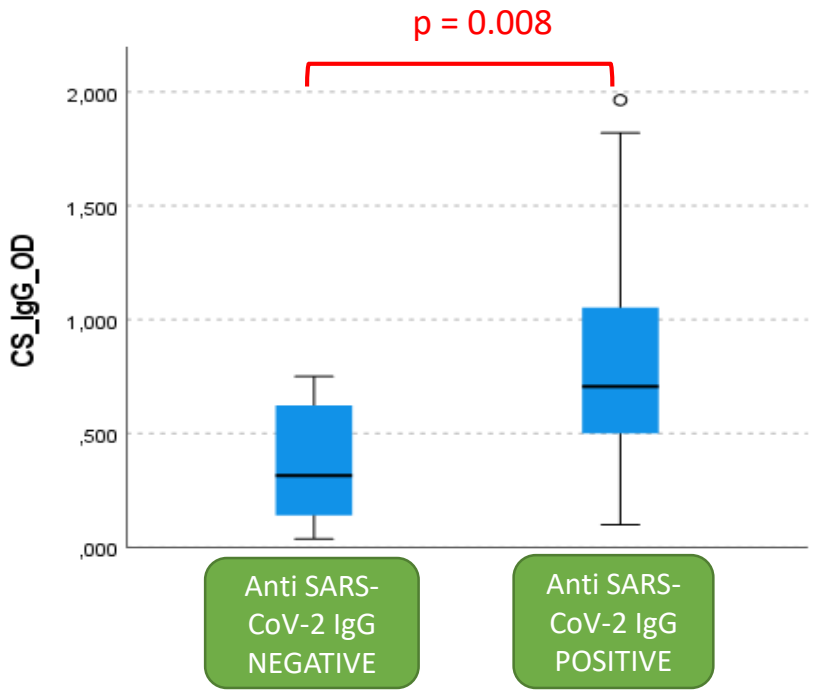
- Personalized natural autoantibody network
- First line of defense, maintanence of the immune homeostatis
- Recognizing evolutionarily conserved structures → protection against autoimmunity
- Autoimmune phenomena → molecular mimicry
- Possible connection between vaccine/infection induced humoral response and natural autoantibodies

Measurement of anti-citrate synthase (CS) natural autoantibody in anti-SARS-CoV-2 IgG positive and negative goups

Total cohort



mRNA vaccine

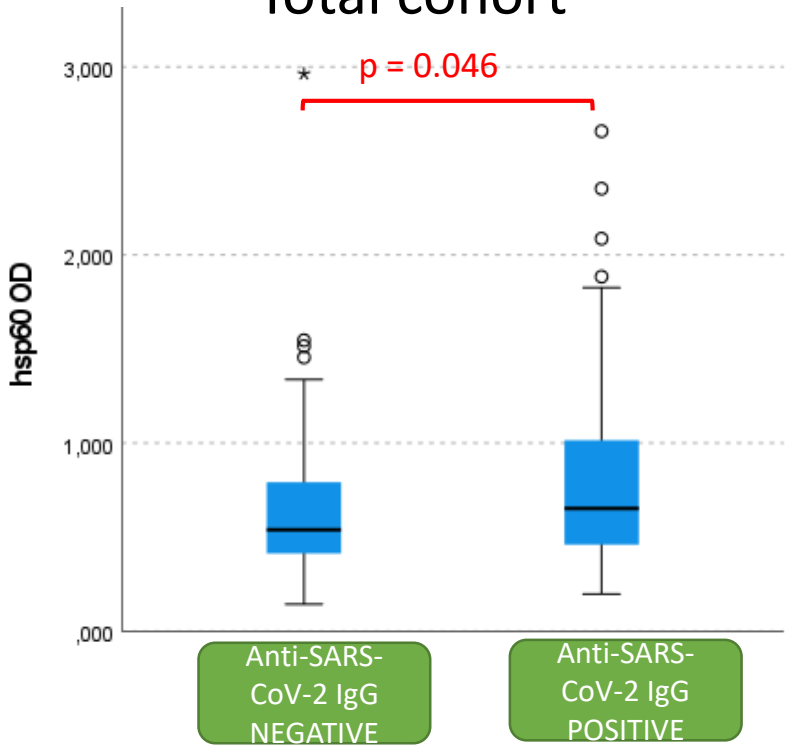


SARS-CoV-2 IgG positive group had higher anti-CS IgG autoantibody level

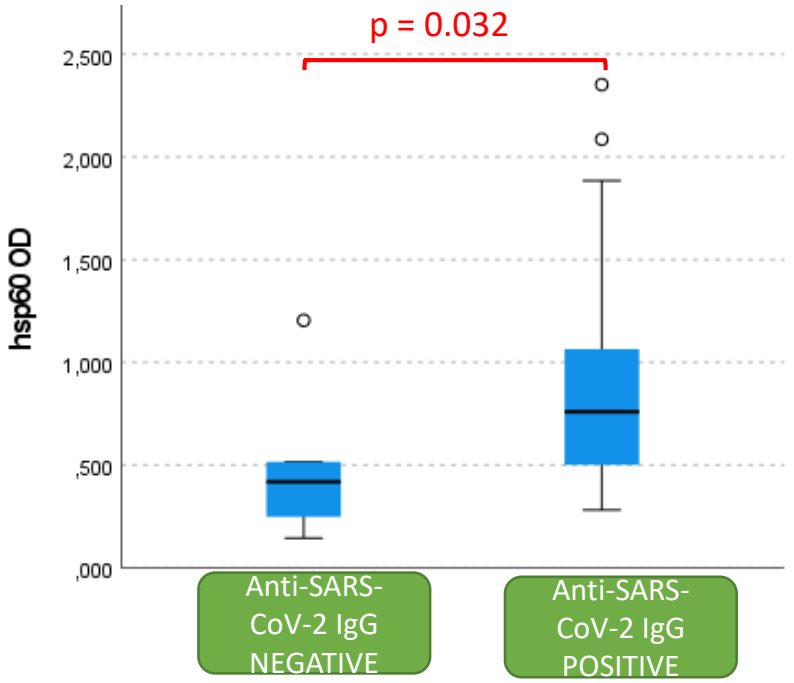
Anti-CS IgG autoantibody in-house ELISA

Level of natural autoantibody against Heat shock protein (Hsp) 60 in anti-SARS-CoV-2 IgG positive and negative goups

Total cohort



mRNA vaccine

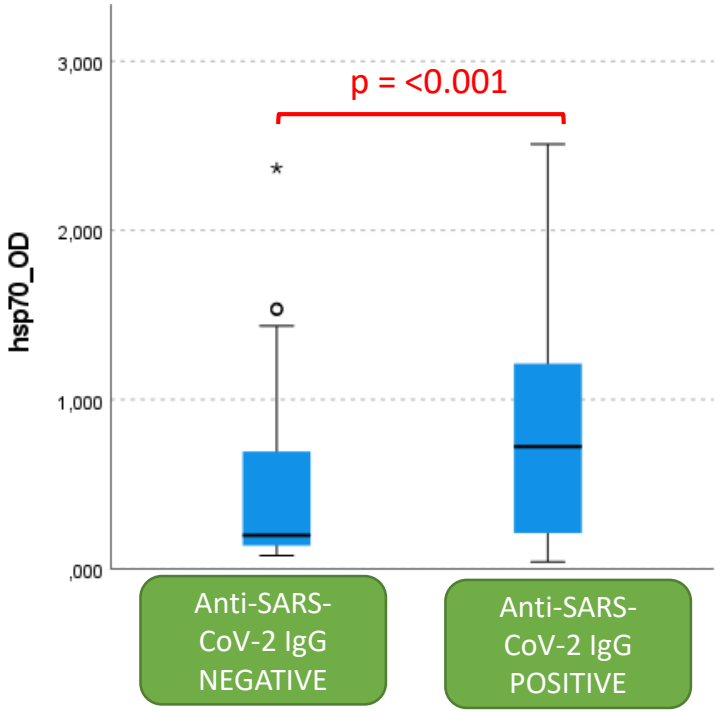


In the SARS-CoV-2 IgG positive group anti-Hsp60 IgG autoantibody level was higher

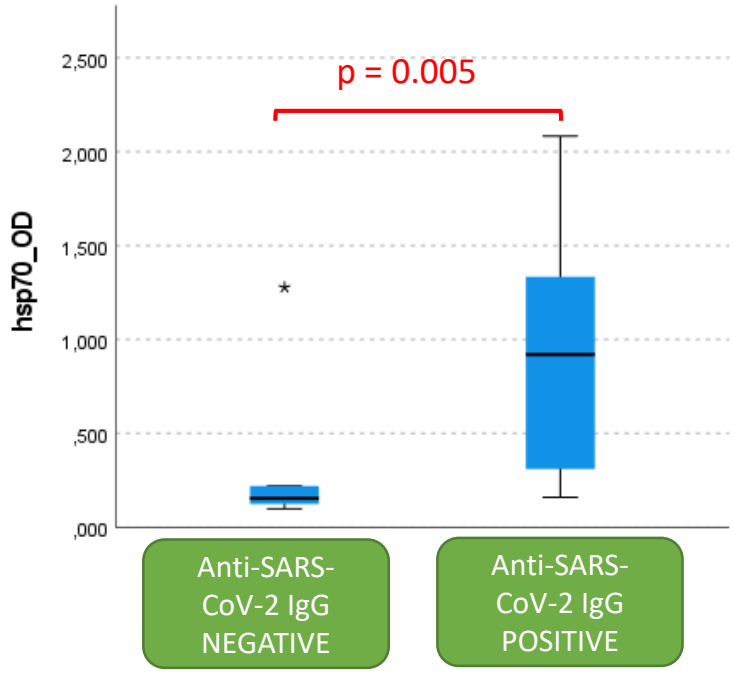
Anti-Hsp60 IgG autoantibody in-house ELISA

Investigation of natural autoantibody against Hsp70 in anti-SARS-CoV-2 IgG positive and negative goups

Total cohort



mRNA vaccine



In the SARS-CoV-2 IgG positive group showed higher anti-Hsp70 IgG autoantibody level

Anti-Hsp70 IgG autoantibody in-house ELISA

Final conclusion

- The mRNA vaccine elicited the strongest humoral and cellular immune responses against the spike protein of SARS-CoV-2
- COVID-19 vaccine or SARS-CoV-2 infection induced IgG isotype antibodies positively correlated with natural autoantibody levels
- The natural autoantibodies may serve as potential screening targets to predict the strength of antigen-induced immune response

Tímea Berki
Péter Németh
Katalin Böröcz
Diána Simon
Ágnes Kinyó
Dániel Orbán

Department of Immunology and Biotechnology, Clinical Center, Medical School, University of Pécs, Hungary

Thank you for attention!

The research was financed by the Thematic Excellence Program 2020-2021 Health Sub-programme of the Ministry for Innovation and Technology in Hungary, within the framework of the EGA-10 project of the Pécs of University.