A human milk perspective on the transmission of maternal factors to her child

Focus on stress, nutrition and immunity

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CHAPTER

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Comparing human milk antibody response after four different vaccines for COVID-19

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Abstract

This study aims to compare the antibody response in human milk after vaccination with mRNA-based and vector-based vaccines.

Background

COVID-19 usually has a mild course in children; however, newborns and infants are more susceptible to severe disease (1). Human milk is suggested to play an important role to protect against infections, mostly owing to disease-specific antibodies (2). Antibodies against SARS-CoV-2 are present in the human milk of previously infected women (3), as well as following vaccination with a SARS-CoV-2 vaccine (4), and are capable of neutralizing the virus. Because maternal vaccination during lactation may protect not only the mother but also her breastfed infant, knowledge of its effect is important to guide health care workers and lactating women in decision-making regarding SARS-CoV-2 vaccination. Therefore, this study aims to compare the antibody response in human milk after vaccination with mRNA-based and vector-based vaccines.

Methods

A total of 4 vaccines are available in the Netherlands: 2 mRNA-based vaccines (BNT162b2 developed by Pfizer-BioNTech and mRNA-1273 developed by Moderna) and 2 vector-based vaccines (AZD1222 developed by Oxford/AstraZeneca and Ad26. COV2.S developed by Johnson & Johnson/Janssen). Lactating women who received full vaccination with 1 of these vaccines were eligible to participate in this prospective longitudinal study. Each participant collected 17 human milk samples over a period of 100 days. Data collection took place from January through July 2021. Ethical approval was acquired from the Ethics Committee of the Amsterdam University Medical Centre. Written informed consent was obtained from all participants.

An enzyme-linked immunosorbent assay with the SARS-CoV-2 spike protein was used as described previously to assess IgA and IgG antibodies in human milk (3). Sample results were considered positive at an optical density 450-nm cutoff value of 0.5 for IgA in human milk (sensitivity, 68%; specificity, 99%) and 0.2 for IgG in human milk (sensitivity, 96%; specificity, 99%). For each vaccine, the percentage of participants with detectable antibodies was calculated and displayed in a Kaplan-Meier curve for IgA and IgG separately.

Results

Participants with detectable SARS-CoV-2–specific antibodies in their milk at baseline (n = 9 for IgA and n = 3 for IgG) or a previous positive polymerase chain reaction test (n = 7) were excluded from further analyses, thus, a total of 1650 human milk samples from 124

lactating mothers were included in the final analysis. Figure, A shows the percentage of participants with detectable IgA during the study period. Almost all participants who received an mRNA-based vaccine showed detectable IgA in their milk, with 25 of 26 (96%) and 37 of 38 (97%) after the BNT162b2 and MRNA-1273 vaccines, respectively. For participants who received a vector-based vaccine, this was remarkably lower, as only 13 of 33 (39%) and 10 of 21 (48%) showed detectable IgA after the AZD1222 and Ad26.COV2.S vaccines, respectively. The percentage of participants with detectable IgG during the study period is depicted in Figure, B. After both doses of BNT162b2, MRNA-1273, and AZD1222 vaccines, all participants showed detectable IgG. However, after the mRNA-based vaccines, this was on day 23 and day 32 after the first dose, while after the AZD1222 vaccine, all participants showed IgG at day 94. After vaccination with Ad26. COV2.S, which is only 1 dose, 6 of 23 (28%) participants had detectable IgG in their milk.

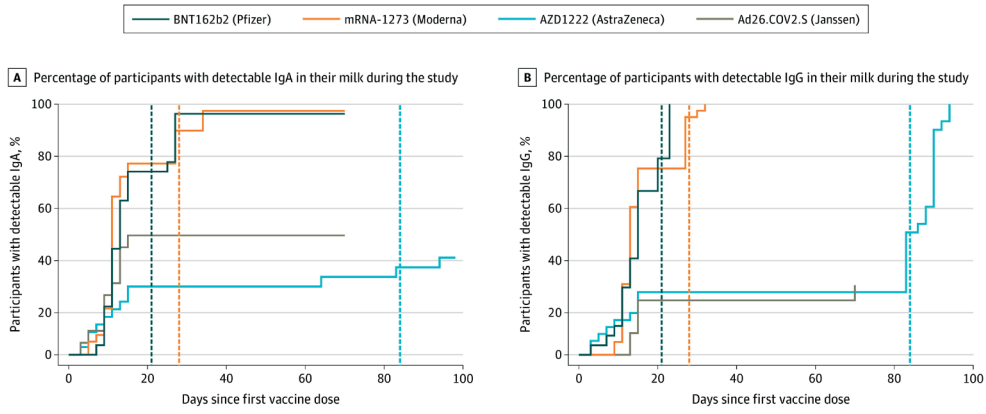

Figure 1: Percentage of Participants With Detectable IgA (panel A) and IgG (panel B) in Their Milk During the Study
The dotted lines indicate timing of the second dose of the vaccines.

Discussion

We demonstrated that SARS-CoV-2–specific IgA in human milk was present more frequently after vaccination with an mRNA-based vaccine compared with a vector-based vaccine. Additionally, IgG was present in all participants after receiving 2 vaccine doses, independent of vaccine type. However, IgG was detectable earlier after vaccination with either of the mRNA vaccines, which can be explained by timing of the second dose. A limitation of this study is that we did not measure neutralizing capacity of the human milk antibodies.

The most abundant antibody in human milk is IgA, which plays a key role in the first line of defense against invading viruses (5). Although, to our knowledge, no studies have shown indisputable evidence that human-milk IgA directly protects against respiratory

tract infections, it is very likely that this antibody plays a critical role. Based on these data, we suggest that an mRNA-based vaccine is the optimal choice for lactating women when they want to transfer antibodies to their infants.

References

1. Götzinger F, Santiago-García B, Noguera-Julián A, et al.; ptbnet COVID-19 Study Group . COVID-19 in children and adolescents in Europe: a multinational, multicentre cohort study. Lancet Child Adolesc Health. 2020;4(9):653-661. doi: 10.1016/S2352-4642(20)30177-2 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
2. Hanson LA. Session 1: Feeding and infant development breast-feeding and immune function. Proc Nutr Soc. 2007;66(3):384-396. doi: 10.1017/S0029665107005654 [PubMed] [CrossRef] [Google Scholar]
3. van Keulen BJ, Romijn M, Bondt A, et al.. Human milk from previously COVID-19-infected mothers: the effect of pasteurization on specific antibodies and neutralization capacity. Nutrients. 2021;13(5):1645. doi: 10.3390/nu13051645 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
4. Perl SH, Uzan-Yulzari A, Klainer H, et al.. SARS-CoV-2-specific antibodies in breast milk after COVID-19 vaccination of breastfeeding women. JAMA. 2021;325(19):2013-2014. doi: 10.1001/jama.2021.5782 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
5. Atyeo C, Alter G. The multifaceted roles of breast milk antibodies. Cell. 2021;184(6):1486-1499. doi: 10.1016/j.cell.2021.02.031 [PubMed] [CrossRef] [Google Scholar]