

Possibility of SARS-CoV-2 transmission from the breast milk of COVID-19 affected women patients to their infants: worries and strategies to counter it

Shailesh Kumar Patel¹, Mamta Pathak¹, Jigyasa Rana², Ruchi Tiwari³, Senthilkumar Natesan⁴, Jaideep Dhama⁵, Yashpal Singh Malik⁶, Alfonso J. Rodríguez-Morales^{7,8,9}, Kuldeep Dhama¹, Pasquale Pagliano¹⁰

¹Division of Pathology, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India;

²Department of Veterinary Anatomy, Faculty of Veterinary and Animal Sciences, Rajeev Gandhi South Campus, Banaras Hindu University, Barkachha, Mirzapur, Uttar Pradesh, India;

³Department of Veterinary Microbiology and Immunology, College of Veterinary Sciences, UP Pt. Deen Dayal Upadhyay Pashu Chikitsa Vigyan Vishwavidyalay Evum Go-Anusandhan Sansthan (DUVASU), Mathura, India;

⁴Indian Institute of Public Health Gandhinagar, Lekawada, Gandhinagar, Gujarat, India

⁵Tara Hospital, Uttam Nagar, New Delhi, India;

⁶Division of Biological Standardization, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India;

⁷Public Health and Infection Research Group, Faculty of Health Sciences, Universidad Tecnologica de Pereira, Pereira, Colombia;

⁸Grupo de Investigacion Biomedicina, Faculty of Medicine, Fundacion Universitaria Autonoma de las Americas, Pereira, Risaralda, Colombia;

⁹Universidad Privada Franz Tamayo (UNIFRANZ), Cochabamba, Bolivia;

¹⁰Department of Infectious Diseases, University of Salerno, Salerno, Italy

The ongoing COVID-19 pandemic caused by severe acute respiratory syndrome coronavirus - 2 (SARS-CoV-2) emerged in Wuhan, China during December 2019 and after that spread like wildfire globally and affected more than 210 countries and territories [1]. The virus has claimed nearly 0.53 million lives out of 11.32 million confirmed cases as of July 3, 2020, and has posed significant threat and panic among the mass population of the world along with substantial economic losses globally. The rapid spread of the virus is attributed to the absence of any effective vaccine and treatment regimen. For this purpose, high ef-

forts are being made by researchers from several countries [2]. The virus has been detected in respiratory droplets and aerosols during sneezing, blood, urine, stool, and saliva, but whether other body fluids such as vomit, urine, semen, or breast milk contain live infectious SARS-CoV-2 is yet to be unraveled [3, 4].

A case report including a COVID-19 infected mother revealed that the PCR test of breast milk sample was found negative after six days of delivery, while the nasopharyngeal swab samples of the mother remained positive for the virus even after eight days of delivery [5]. In a study, amniotic fluid, cord blood, and neonatal throat swab along with breast milk samples from six out of nine COVID-19 patients were tested for the SARS-CoV-2 and all samples were found negative for the virus, suggesting that human breast milk samples from COVID-19 infected mothers remain free from the SARS-CoV-2 [6]. In contrast to this, re-

Corresponding authors

Kuldeep Dhama

E-mail: kdhama@rediffmail.com

Alfonso J Rodriguez-Morales

E-mail: arodriguez@utp.edu.co

cently, the SARS-CoV-2 RNA was detected in the breast milk of a mildly symptomatic COVID-19 patient, but the presence of the live virus in breast milk is still under investigation [7]. The body cells expressing angiotensin-converting enzyme 2 (ACE2) serves an essential mode for the internalization of the SARS-CoV-2 virus [8]. ACE2 receptors are expressed in several organs, including myoepithelial cells of mammary glands, and thereby the possibilities of SARS-CoV-2 virus transmission through mother's milk to infants cannot be ignored based on minimal control trial studies conducted [9, 10]. However, no evidence of viral transmission from breast milk is available; few studies recommended that SARS-CoV-2 infected mother should not breastfeed their young ones [11-13]. Moreover, the voiding of contaminated droplets by the infected mother during breastfeeding could be an essential source of virus transmission to neonates [14]. In this context, the National Health Commission of China recommended isolating the neonates of suspected or confirmed COVID-19 pregnant women for a period of a minimum of 14 days with a restriction on breastfeeding [15].

The rapid progression of coronavirus pandemic has left the pregnant women in fear and uncertainties regarding the breastfeeding dilemma and neonatal care. Moreover, recommendations against breastfeeding without conclusive evidence may lead to severe newborn health issues and detrimental effects on the early development of the child [16]. Additionally, such recommendations may potentially contribute to the reduction of breastfeeding by the women even in the absence of COVID-19 due to fear of the disease transmission. Therefore, at present, abstaining from breastfeeding is not recommended based on the lack of enough pieces of evidence regarding the presence of SARS-CoV-2 in breast milk [17]. Additionally, COVID-19 infection was not observed in the newborn even after practicing breastfeeding and free attachment with the SARS-CoV-2 infected mothers provided with the implementation of strict preventive measures [18]. A recent study reviewing the data from 60 pregnant women with COVID-19 strongly supports the low rate of vertical transmission of SARS-CoV-2, as it did not reveal any case of infection in 18 newborns from infected women having vaginal delivery. Moreover, no case of infection was reported

in newborns during the follow-up, although the majority was breastfed. Placental examination did not reveal SARS-CoV-2 in the cases analyzed. These observations can justify a change in the recommendations to pregnant women with COVID-19 due to the apparent safety of vaginal delivery and the low rate of transmission after breastfeeding [19].

Recently, a study reported the presence of specific IgG antibodies against SARS-CoV-2 in the breast milk of an infected woman at 13 months postpartum, suggesting the possible protective effect of breastfeeding on neonates through passive immune protection to the infants [20]. Moreover, the timing of antibody response against SARS-CoV-2 in human milk is not yet known [10]. Considering the nutritional benefits and strong protective effect of passive immunity via the breast milk against infectious agents, the CDC and the WHO advised that breastfeeding of young ones, even in case of suspected or confirmed COVID-19 infected mothers, should be determined by the mother, her family, and healthcare supervisors while taking all possible preventive measures such as wearing a mask, washing of hands and breasts with soap and water along with the adoption of good personal hygiene before breastfeeding [10, 20]. The UNICEF and Italian Society of Neonatology have also supported the continuation of breastfeeding in mothers even affected with COVID-19 disease, but with appropriate hygiene measures [21]. In this context, indirect breastfeeding may also be promoted to avoid disease transmission via respiratory aerosols while ensuring strict preventive measures [20].

Moreover, breastfeeding in SARS-CoV-2 infected women postpartum is highly recommended for the neonates if the health of the mother and infant allows it. If the mother's health does not allow it, then milk expression should be carried out and fed unpasteurized to the young ones while following proper cleaning of breasts, utensil, and pumps [22]. In this context, feeding of expressed mother's milk is reported to be the first choice over breastfeeding in the case of COVID-19 infected mother to avoid the contact of the child's mouth with the mother's breast [23]. Furthermore, another study suggested that breastfeeding can be practiced once the isolation period is over, and the mother test negative for SARS-CoV-2. Additionally, breast pumping is recommended dur-

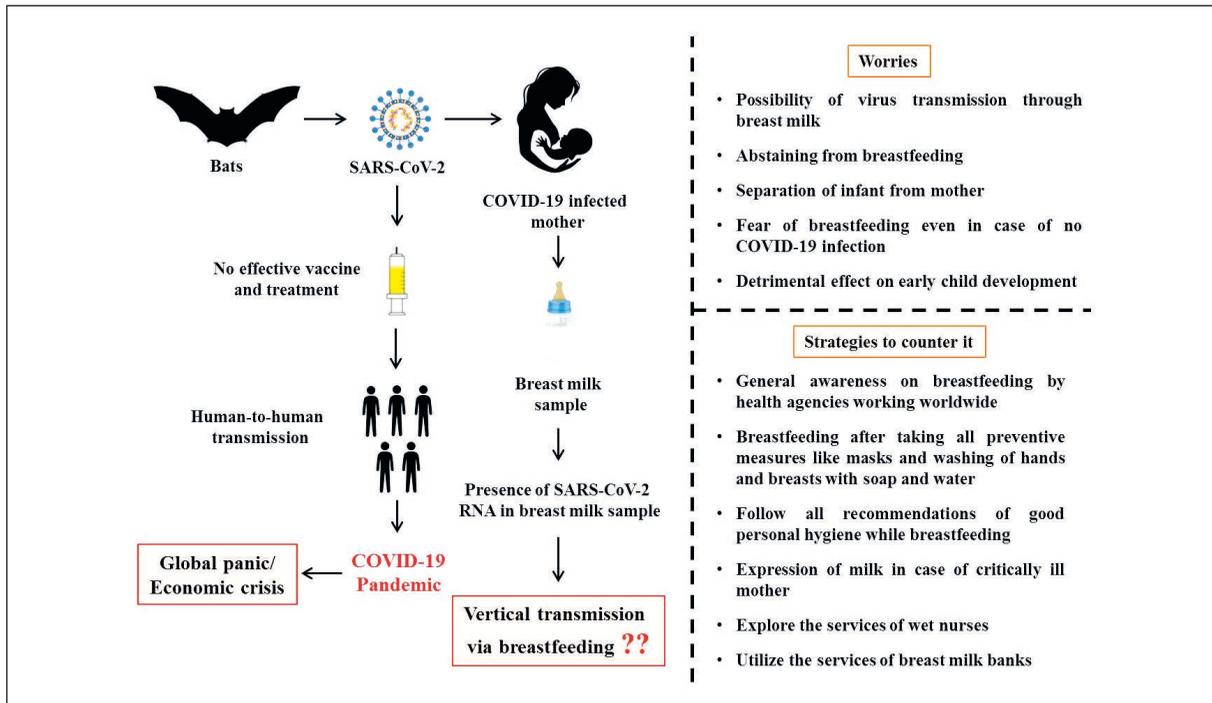


Figure 1 - An overview of the possibility of SARS-CoV-2 transmission from the breast milk of COVID-19 affected women patients to their infants, worries, and strategies to counter it.

ing the isolation period to resume breastfeeding, usually, once the isolation period is passed [24]. In case of a mother being too ill to breastfeed or expressed milk, it is advisable to explore the possibility of other healthy breast milk donors (wet nurse) to feed the infant of a COVID-19 infected mother. Proper testing of such donors for COVID-19 must be carried out to rule out the possibilities of any asymptomatic SARS-CoV-2 infection. Besides, good personal hygiene of the donor should be ensured before allowing for breastfeeding to avoid unintentional virus transmission to the infant.

Moreover, donor milk may be procured from breast milk banks, which have gained enough popularity as an essential source of milk supplementation to infants unable to receive mother's milk due to any unavoidable circumstances [25]. In this context, human breast milk banks may also prove crucial in this emergency created by the COVID-19 pandemic. Also, to limit the chances of detrimental effects in neonates speculated to be produced by the drug residues during SARS-CoV-2 infection from the affected mother, the

breast pump feeding or milk banks may serve as an essential option.

Pictorial representation of the possibility of transmission of SARS-CoV-2 from the breast milk of COVID-19 affected women patients to their infants, related worries, and strategies to prevent is presented in Figure 1.

Conflict of interest

None

Funding

none

REFERENCES

- [1] Dhama K, Sharun K, Tiwari R, et al. Coronavirus disease 2019-COVID-19. *Clin Microbiol Rev.* 2020; 33 (4), e00028-20.
- [2] Dhama K, Sharun K, Tiwari R, et al. COVID-19, an emerging coronavirus infection: advances and prospects in designing and developing vaccines, immunotherapeutics, and therapeutics. *Hum Vaccin Immunother.* 2020; doi: 10.1080/21645515.2020.1735227.
- [3] Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics

- of Coronavirus disease 2019 in China. *N Engl J Med.* 2020; 382 (18), 1708-20.
- [4] Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA.* 2020; 323 (18), 1843-4.
- [5] Dong L, Tian J, He S, Zhu C, Wang J, Liu C, Yang J. Possible vertical transmission of SARS-CoV-2 from an infected mother to her newborn. *JAMA.* 2020; 323 (18), 1846-8.
- [6] Chen H, Guo J, Wang C, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet.* 2020; 395 (10226), 809-15.
- [7] Tam PCK, Ly KM, Kernich ML, et al. Detectable severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in human breast milk of a mildly symptomatic patient with coronavirus disease 2019 (COVID-19). *Clin Infect Dis.* 2020; doi: 10.1093/cid/ciaa673.
- [8] Yan R, Zhang Y, Li Y, Xia L, Guo Y, Zhou Q. Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2. *Science.* 2020; 367 (6485), 1444-8.
- [9] Xu H, Zhong L, Deng J, et al. High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. *Int J Oral Sci.* 2020; 12 (1), 8.
- [10] Lackey KA, Pace RM, Williams JE, et al. SARS-CoV-2 and human milk: What is the evidence? *Matern Child Nutr.* 2020; doi: 10.1111/mcn.13032.
- [11] Fan C, Lei D, Fang C, et al. Perinatal transmission of COVID-19 associated SARS-CoV-2: Should we worry? *Clin Infect Dis.* 2020; doi: 10.1093/cid/ciaa226.
- [12] Liu W, Wang Q, Zhang Q, et al. Coronavirus disease 2019 (COVID-19) during pregnancy: A case series. *Preprints* 2020; 2020020373.
- [13] Wang S, Guo L, Chen L, et al. A case report of neonatal COVID-19 infection in China. *Clin Infect Dis.* 2020; doi: 10.1093/cid/ciaa225.
- [14] Rasmussen SA, Smulian JC, Lednicky JA, Wen TS, Jamieson DJ. Coronavirus Disease 2019 (COVID-19) and pregnancy: what obstetricians need to know. *Am J Obstet Gynecol.* 2020; doi: 10.1016/j.ajog.2020.02.017.
- [15] Wang L, Shi Y, Xiao T, et al. Chinese expert consensus on the perinatal and neonatal management for the prevention and control of the 2019 novel coronavirus infection (First edition). *Ann Transl Med.* 2020; 8 (3), 47.
- [16] Martins-Filho PR, Santos VS, Santos HP Jr. To breastfeed or not to breastfeed? Lack of evidence on the presence of SARS-CoV-2 in breast milk of pregnant women with COVID-19. *Rev Panam Salud Publica.* 2020; 44, e59.
- [17] Duran P, Berman S, Niermeyer S, et al. COVID-19 and newborn health: systematic review. *Rev Panam Salud Publica.* 2020; 44, e54.
- [18] Lowe B, Bopp B. COVID-19 vaginal delivery - A case report. *Aust N Z J Obstet Gynaecol.* 2020; 60 (3), 465-6.
- [19] Pereira A, Cruz-Melguizo S, Adrien M, Fuentes L, Marin E, Perez-Medina T. Clinical course of coronavirus disease-2019 in pregnancy. *Acta Obstet Gynecol Scand.* 2020; 99 (7): 839-47. doi:10.1111/aogs.13921
- [20] Yu Y, Xu J, Li Y, Hu Y, Li B. Breast milk-fed infant of COVID-19 pneumonia mother: A case report. *Research Square* 2020; doi: 10.21203/rs.3.rs-20792/v1.
- [21] Davanzo R, Moro G, Sandri F, Agosti M, Moretti C, Mosca F. Breastfeeding and coronavirus disease-2019: Ad interim indications of the Italian Society of Neonatology endorsed by the Union of European Neonatal & Perinatal Societies. *Matern Child Nutr.* 2020; 16 (3), e13010.
- [22] Fernández-Carrasco FJ, Vázquez-Lara JM, González-Mey U, Gómez-Salgado J, Parrón-Carreño T, Rodríguez-Díaz L. Infección por coronavirus Covid-19 y lactancia materna: una revisión exploratoria. *Rev Esp Salud Publica.* 2020; 94, e202005055.
- [23] Stanojević M. Are Covid-19-positive mothers dangerous for their term and well newborn babies? Is there an answer? *J Perinat Med.* 2020; 48 (5), 441-5.
- [24] Lang GJ, Zhao H. Can SARS-CoV-2-infected women breastfeed after viral clearance? *J Zhejiang Univ Sci B.* 2020; 21 (5), 405-7.
- [25] Marinelli KA. Wet nurses to donor milk banks and back again: the continuum of sharing our milk to save lives. *J Hum Lact.* 2020; 36 (2), 213-6.