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Review article

Milk banks and COVID-19: Scoping review

Bancos de leche humana y COVID-19: revisión de alcance sistemático

Bancos de leite e COVID-19: revisão de alcance sistemático

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Summary

Objective: To conduct a review of the scope of published information on biosecurity in human milk banks during the COVID-19 pandemic.

Methodology: A bibliographic search was carried out in the Medline, EMBASE, LILACS, and World Health Organization databases, the Cochrane Database of Systematic Reviews, and Google Scholar, of studies with qualitative and quantitative methodology such as systematic reviews, observational studies, case reports, as well as technical management documents and editorials with technical management proposals, published both in English and Spanish between January 1 and June 2, 2020.

The MeSH terms used were: milk banks, breastfeeding, SARS virus, and COVID-19. The DeCS terms were: milk banks, milk extraction, SARS virus, and coronavirus infections.

Results: Overall, 577 titles were found, 537 were excluded in the selection and 18 in the full-text review phase; 22 were included in the synthesis. No evidence of viral transmission was found for human milk, but evidence regarding contact transmission as well as barrier measures to prevent contagion was identified. There are different positions on the use of pasteurized or unpasteurized human milk, due to the protective biological properties that breast milk provides without the pasteurization process, and the lack of evidence of COVID-19 transmission in milk.

Resumen

Objetivo: revisar la información publicada sobre el manejo de la bioseguridad en los bancos de leche humana, el procesamiento de muestras de leche humana y la selección de donantes durante la pandemia por COVID-19.

Métodos: se realizó una búsqueda bibliográfica en *Medline, EMBASE, LILACS*, bases de datos de la Organización Mundial de la Salud, Base de Datos *Cochrane* de Revisiones Sistemáticas y *Google Scholar*. Se incluyeron estudios con una metodología cualitativa y cuantitativa como revisiones sistemáticas, estudios observacionales, informes de casos, así como documentos de gestión técnica, editoriales con propuestas de gestión técnica, en inglés y español, publicados entre el 1 de enero y el 2 de junio de 2020. Los términos *MeSH* utilizados fueron: bancos de leche, lactancia materna, virus SARS-COV-2 y COVID-19. Los términos de DeCS fueron: bancos de leche, extracción de leche, virus del SARS e infecciones por coronavirus.

Resultados: se encontraron 577 títulos, se excluyeron 537 en la selección y 18 en la fase de revisión de texto completo, fueron incluidos 22 títulos para síntesis. No se encontró evidencia de transmisión viral a través de la leche humana, pero sí de transmisión por contacto. Se encontraron medidas de barrera para prevenir el contagio. Existen diferentes posiciones sobre el uso de leche humana pasteurizada o no pasteurizada, debido a las propiedades

Resumo

Objetivo: rever as informações publicadas sobre a gestão da biossegurança nos bancos de leite humano, o processamento de amostras de leite humano e a seleção de doadores durante a pandemia por COVID-19.

Métodos: foi realizada uma pesquisa bibliográfica nas bases de dados *Medline, EMBASE, LILACS*, bases de dados da Organização Mundial de Saúde, *Cochrane Database of Systematic Reviews* e *Google Scholar*. Foram incluídos estudos com uma metodologia qualitativa e quantitativa, como revisões sistemáticas, estudos observacionais, relatos de casos, bem como documentos de gestão técnica, editoriais com propostas de gestão técnica, em inglês e espanhol, publicados entre 1 de janeiro e 2 de junho de 2020. Os termos *MeSH* usados foram: bancos de leite, aleitamento materno, vírus SARS-COV2 e COVID-19. Os termos do DeCS foram: bancos de leite, extração de leite, vírus SARS e infeções por coronavírus.

Resultados: foram encontrados 577 títulos, se excluíram 537 na seleção e 18 na fase de revisão do texto completo, foram incluídos 22 títulos para síntese. Não se encontrou evidência de transmissão viral através do leite humano, mas sim de transmissão por contato. Foram encontradas medidas de barreira para prevenir o contágio. Existem diferentes posições quanto ao uso do leite humano pasteurizado ou não pasteurizado, devido às

Conclusion: In terms of biosecurity measures, it is essential to assess the health of the donor, encourage the use of standardized unpasteurized milk as well as the use of pasteurized heterologous human milk depending on the relevant circumstances, and to implement protective measures in human milk banks.

Keywords: Breast milk extraction; Milk banks; SARS; SARS virus; Coronavirus infections.

biológicas protectoras que proporciona la leche materna no pasteurizada. Como medidas principales de protección contra la infección se hace énfasis en el uso de leche materna autóloga y en garantizar el buen estado de salud de la mujer donante.

Conclusión: las medidas de bioseguridad recomendadas en bancos de leche humana, previa valoración del estado de salud de la mujer donante, determina el uso de leche humana heteróloga u homóloga. Se recomienda fomentar el uso de leche autóloga no pasteurizada.

Palabras clave: leche materna, bancos de leche, virus del SARS, infecciones por coronavirus.

propriedades biológicas protetoras que o leite humano não pasteurizado proporciona. As principais medidas de proteção contra a infeção se faz enfase no uso de leite materno autólogo (LH) e a garantia da boa saúde da mulher doadora.

Conclusão: as medidas de biossegurança recomendadas em bancos de leite humano, avaliação prévia do estado de saúde da doadora, determinar o uso de leite humano heterólogo ou homólogo. Recomenda-se fomentar o uso de leite autólogo não pasteurizado.

Palavras-chave: leite materno, bancos de leite, vírus SARS, infeções por coronavírus.

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INTRODUCTION

On December 31, 2019, the first case of what is now known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported to the Chinese Center for Disease Control and Prevention[1]. On January 3, 2020, 44 cases were reported in China, on January 7, a new coronavirus was isolated and, on January 12, the Chines authorities reported its genetic sequence[2,3].

The International Committee on Taxonomy of Viruses (ICTV) designated this coronavirus as "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" on February 11[4]. This name was chosen because the virus is different from the previous genetically related coronaviruses found to be the cause of Severe Acute Respiratory Syndrome (SARS) in 2003[5]. The World Health Organization (WHO) selected the short name "COVID-19" to designate the disease caused by SARS-CoV-2[6].

Coronaviruses take their name from the crown-shaped spikes on their surface (Latin: corona = corona). They are RNA viruses belonging to the Coronavirinae subfamily of the Coronaviridae family of the Nidovirales order[7], and they are divided into four main subgroups: alpha, beta, gamma, and delta, according to their genomic structure. Alpha and beta coronaviruses infect only mammals, generally causing respiratory symptoms in humans and gastroenteritis in other animals[8].

The experience with the disease in China showed that some population groups respond differently to SARS-CoV-2 infection[9]: the elderly, people with comorbidities, and immunosuppressed patients[10,11]. Other population groups requiring specific clinical management against the risk of infection by SARS-CoV-2 are pregnant women, women in childbirth care, and newborns[10].

The declaration of the pandemic status by the WHO on March 11, 2020[12] spurred the need to revisit all activities pertaining to maternal and child care, specifically childbirth, neonatal care, and breastfeeding[11,13,14]. Similarly, the management of milk banks and the use of donor human milk (DHM) destined for the population of premature neonates raise specific concerns, considering the social and health impact of this issue, and the risk infection[15].

Human milk banks (HMBs) are defined as specialized services responsible for the promotion, protection, and support of breastfeeding. Their activities include DHM collection, processing, quality control, classification, conservation, and distribution[16].

Milk extraction and conservation in HMBs include extraction, handling of aliquots, implementation

of biosafety processes, and transport regulation[17]. Pasteurization is defined as the mechanical process of milk treatment to destroy infectious biological material and includes all operations required to ensure the quality of the product at its final destination[17,18].

The context of this review is the material published on HMBs in countries that experienced the SARS-CoV-2 / COVID-19 pandemic. The search focused on experiences regarding the development of biosecurity standards for donor selection, transport, storage, extraction, conservation, repackaging, and pasteurization of human milk (HM)[17,19,20].

A scoping review[21,22] of the available medical literature on the subject is proposed with the aim of assessing emerging information related to biosafety in HMBs, human milk (HM) sample processing, and donor selection[22].

METHOD

Design

Scoping review based on the Joanna Briggs Institute methodology[22].

Types of sources queried

Information related to the management of HMBs and the current SARS-CoV-2 / COVID-19 pandemic was included; the topics selected for this scoping review on the subject of HMBs and SARS-CoV-2 / COVID-19 virus infection were:

- Experiences regarding HBM management under pandemic conditions created by the SARS-CoV-2 / COVID-19 infection.
- Technical studies on pasteurization processes in milk banks during the SARS-CoV-2 / COVID-19 pandemic.
- Proposals for the management of HMBs within the framework of the SARS-CoV-2 / COVID-19 pandemic.
- Biosecurity standards for donors, clinical management of selected donors.
- Risk of viral transmission of SARS-CoV-2 / COVID-19 through milk[23,24].

Inclusion criteria

- Studies with qualitative and quantitative methodology: systematic reviews, observational studies, case reports, technical management documents, editorials with proposals for HMBs regarding technical handling of samples.
- Language was included as part of search limits (documents written in English and Spanish).
- Time of publication (between January 1 and June 2, 2020).
- Technical documents with other publication dates, with the aim of defining some of the concepts and processes.

Exclusion criteria

- Literature not related to the topic of human milk banks and the current pandemic.

Search strategy

The search was conducted in the following databases: Medline (via Pubmed), EMBASE, LILACS, World Health Organization (WHO), Cochrane Database of Systematics Reviews, and Google Scholar.

The search terms used in English were: human milk bank, human milk donor, Severe Acute Respiratory Syndrome (SARS), the supplementary COVID-19 concept; and the terms used in Spanish were: human milk banks, human milk donor, severe acute respiratory syndrome (SARS), coronavirus infections and COVID-19. Table 1 shows the search strategies used in each of the databases.

It is important to note that several of the reviewed articles have not yet been published (gray literature), hence the use of prepublication databases such as BioRxiv and MedRxiv.

Screening of references and selection of studies

Data selection was made in two phases, first by title and abstract, and then by full text. The whole process was done in duplicate and independently. Disagreements were resolved through discussion of the inclusion criteria.

Study quality assessment

In cases in which it was applied, the methodology proposed by the Joanna Briggs Institute was used for the evaluation of qualitative and quantitative observational studies[22].

Data extraction

The selection of documents and abstracts was carried out by one researcher, while a second researcher worked on primary source verification, randomly evalua-

Table 1. Search strategies used

Database	Search strategies
Medline (via pubmed)	(milk banks[MeSH Terms] OR breast feeding[MeSH Terms]) AND (SARS virus[MeSH Terms] OR COVID19 virus)
Embase	#1. ('milk bank'/exp OR 'breast feeding'/exp) AND ('sars coronavirus'/exp OR 'coronavirus disease 2019'/exp) #2. #1 AND 2020:py AND [embase]/lim NOT ([embase]/lim AND [medline]/lim)
Cochrane Database of Systematic reviews	#1. MeSH descriptor: [Milk Banks] this term only #2. MeSH descriptor: [Breast Feeding] explode all trees #3. MeSH descriptor: [SARS Virus] explode all trees #4. milk banks #5. breast feeding #6. sars virus #7. (#1 OR #2 OR #4 OR #5) AND (#3 OR #6)
Scholar Google	("human milk bank" OR "human milk donor") AND ("Severe Acute Respiratory Syndrome" OR "SARS" OR "COVID 19")
Lilacs	tw:((tw:(("human milk bank" OR "breast feeding"))) AND (tw:(("Severe Acute Respiratory Syndrome" OR "SARS" OR "COVID 19")))) AND (db:("LILACS"))

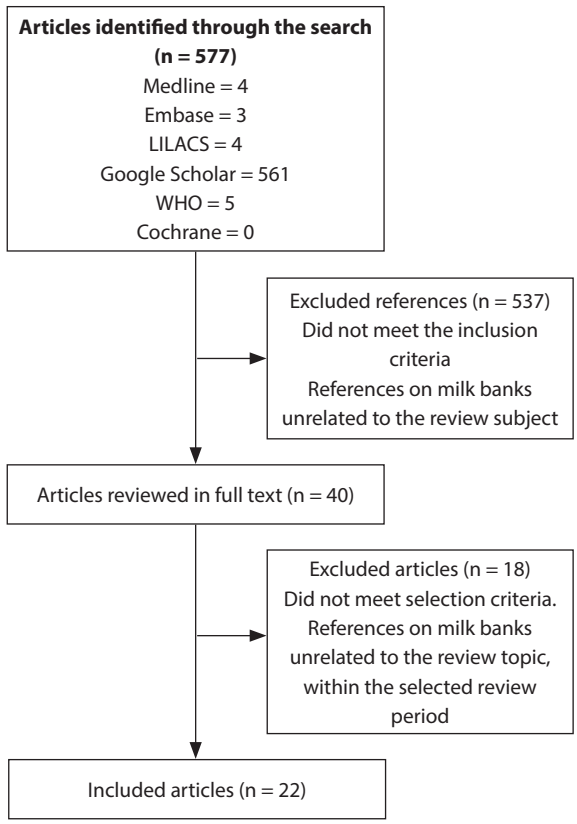

Figure 1. PRISMA diagram of the search, screening and selection process

ting 10% of the bibliography. The initial information search team consisted of four co-investigators.

A predesigned form in Excel® was used to reference the following information: bibliographic database, year of publication, name of the journal, design, authors, country and language, study questions, objectives, interventions, type of intervention and comparator, and a summary of the results or content of the publication.

A PRISMA flow diagram[25] was prepared to display the results of the searches and the screening and full-text selection process, as shown in Figure 1.

Results analysis and presentation

The technical guidelines for HMBs published by the Colombian Ministry of Health[17] were reviewed; and the information was presented in accordance with the following categories:

- Donor recruitment, selection, and accompaniment
- Milk extraction and conservation, and handling of aliquots and containers.
- Transport of milk in HMBs
- Vertical transmission
- Pasteurization
- Bacteriological evidence regarding pasteurization processes to determine whether pasteurized milk should be used in HMBs

Considering the objective of the document, the information is presented in narrative form in summary tables of findings. The recommendations of the PRISMA statement were taken into account for the presentation of the results[25,26].

RESULTS

Literature search results

Overall, 577 titles were identified. The selection of articles was made based on title and abstract, and 537 items that did not meet the selection criteria were excluded. Of 40 full-text documents reviewed, 22 were finally included. The details of the selection process are synthesized in Figure 1 and the characteristics of the documents included are shown in Table 2.

Table 2. Characteristics of the documents included in the review

No. Reference	Date	Country	Objetive	Population	Method, design or type of publication	Type of intervention and comparator	How are the results measured?
1[27]	March 2020	UK	Present a position regarding milk banks	Nursing mothers	Bibliographic review Author's position	NA	NA
Given the lack of evidence regarding SARS-MERS transmission through HM, the pasteurization controversy is discussed; the need for clinical assessment in all cases of suspected infection is discussed; observing the mother for two weeks is suggested while temporarily discontinuing milk provision.							
2[41]	March 2020	China	Letter, annotation	Symptomatic patients Personal experience	Data from collected samples Personal experience	Evaluation of viral load at various infection times	Viral load
*Variation of viral load according to symptom onset; detection in fomites.							
3[17]	March 2019	Colombia	Conceptual, technical and operational guidelines of Human Milk Banks (HMB) in Colombia	Milk banks	Bibliographic review Technical concepts of in accordance with current regulations	NA	NA
*Full updated description on the management of milk banks in Colombia, establishing positions and technical guidelines. Reference document.							
4[47]	April 2020	USA	Stablish a position regarding milk banks	Nursing mothers	Bibliographic review	Document review	NA
Based on relevant experiences with other pandemics, the position of pasteurization of HM aliquots is adopted. Evolution of pasteurization methods; in case of risk of HM contact transmission, implementation of protection measures for mother and child and milk donor assessment are recommended							
5[13]	March 2020	Italy	Stablish a position regarding milk banks	Nursing mothers	Bibliographic review	Document review	NA
Thematic bibliographic review (1) Contact transmission, unlikely by fomites, transplacental transmission? depends more on the mother's disease than on transmission to the fetus. NB (CV +), horizontal transmission, pause-asymptomatic infection; (2) children and infants, evidence of transmission of IgM in milk (protective role), management of the mother and the NB according to health status: healthy, suspect, infected. Various management positions for mother and child are reviewed: management of protection measures, summary thereof.							
6[15]	May 2020	UK	Establish a position regarding milk banks	Nursing mothers	Bibliographic review	Ddocument review	NA
The starting point is the position that there is no adequate evidence yet for the management of milk banks. Upholds the view that breastfeeding prevails over risk, use of precautionary measures, fostering all behaviors that optimize the continuity of breast feeding: important objective to maintain HM nutrition in the neonate; evaluation of aseptic measures in HMB, development of strategies to collect data from experiences of other HMBs.							
7[11]	January 2020	USA	Recommendations for obstetric management and neonatal care in a pandemic	Mother and newborn	Bibliographic review	Document review	NA
Recommendations on protection measures in maternal care due to the risk of SARS virus infection and its consequences; considerations regarding BM in case of suspected maternal infection; milk extraction in MB, or healthy donors. Use of telemedicine to monitor BF and neonate.							
8[24]	2014	USA	Assess the permanence of the SARS virus in different types of mammalian milk	Aliquotes of mammalian milks. Evaluation of the pasteurization process	Laboratory report	Permanence of the virus in pasteurized milk	NA
Given lack of knowledge of the form of transmission of the MERS-CoV in humans, suggests the possibility of contagion through contaminated food products. Evaluation of the permanence of the virus in different types of mammalian milk after pasteurization as a measure to protect agains the intake of contaminated products.							

Table 2. Characteristics of the documents included in the review (*continued*)

No. Reference	Date	Country	Objetive	Population	Method, design or type of publication	Type of intervention and comparator	How are the results measured?
9[42]	2006	USA	Present different sterilization methods	Various aliquots to evaluate various methods of sterilization of blood products and SARS	Laboratory techniques	Viral dilution and inactivation techniques in various blood products and sterilization methods	Comparison and measurement of viral titers
Given the risk of contagion by transfusion of various blood products and SARS, different sterilization techniques were evaluated, and various sterilization methods should be used.							
10[28]	May 2020	Brazil	Provide a summary of human milk bank management	Donors and recipients	Report of sanitary measures	NA	NA
HM collection, processing, pasteurization, and distribution route. Technical standard 01/20, 170320 (Brazil): Cleaning practices for areas, equipment for donor use, and equipment for operator use, transportation, reception, and distribution.							
11[23]	2000	USA	Evaluation of HM antiviral action for CMV and Rhinovirus	Aliquots of LM in cell cultures infected with CMV and Rhinovirus, multi-component action with antiviral activity	Laboratory techniques	Various laboratory techniques to evaluate viral growth	Inhibition of viral growth plaques in cell cultures
The inhibition of CMV growth in cells was partially demonstrated mainly through lactoferrin action; the presence of secretory IgA also neutralized the growth of rhinovirus							
12[33]	April 2020	UK	Reflections on the current pandemic	Milk banks, NU	Thought position	NA	NA
Examines the difficulties that exist in obtaining BM donors, and the risk for premature newborns, which has led to rationalize the use of pasteurized BM for extreme prematurity. Campaigns are required; also donor-related challenges increase due to increased number of requirements for donating milk.							
13[19]	March 2020	USA	Establish a position regarding milk banks	Milk banks, possible HM donors	Thought position	NA	NA
Different experiences in China, Italy, and the US are discussed in relation to the situation of milk donors, how milk donation has been affected by confinement during the pandemic, and what strategies were used to maintain milk demand. There is a position difference between the CDC and WHO / UNICEF regarding the use of human milk, in which the principle of the benefit of human milk for the health of newborns prevails. Recommendations regarding hygiene measures in donor mothers, and management of mothers under suspicion and of those infected by Covid-19; in the latter, the use of pasteurized milk, as well as individual heated containers are recommended.							
14[67]	March 2020	USA	Establish a position regarding milk banks and container handling	Milk banks, possible HM donors	Thought position	NA	NA
It is suggested that all containers received at milk banks need to be disinfected given that it is not possible to determine who is healthy and who is a healthy carrier; therefore, disinfection should be used for all samples that are received. Regular use of all protection elements and whenever contagion is suspected.							
15[29]	March 2020	USA	Present handling of material by health workers, to reduce the risk of SARS-CoV-2 infection	Healthcare workers	Literature review and recommendations	NA	NA
Recommendations for the use of protection against droplets and surface/fluid contact, transport of samples, inpatient and outpatient management.							
16[45]	May 2020	Germany	Report the presence of SARS-CoV-2 in milk	Mother and newborn	Laboratory report	NA	NA
The presence of SARS-CoV-2 is reported in milk extracted from a COVID + mother, as well as symptoms in the baby, over a period of several days. Only two patients, one positive case.							

Table 2. Characteristics of the documents included in the review (*continued*)

No. Reference	Date	Country	Objetive	Population	Method, design or type of publication	Type of intervention and comparator	How are the results measured?
17[40]	April 2020	USA	Review the evidence of the presence of SARS-CoV-2 in HM	Nursing mothers and NB	Literature review and recommendations	NA	NA
The transmission modes of SARS-CoV19 are still unknown, minimal evidence on vertical viral transmission. There are reports with isolated cases, some positive and others negative. Previous exposures of viral infections transmitted by human milk, such as HIV and CMV and lymphotropic virus type T are known. For SARS CoV-2 so far there is no evidence of transmission through HM; they present cases of mothers with viral presence in bodily fluids is 9 studies, but inconclusive for HM. The membrane receptor NL63, essential for the replication of the virus, is present in mammary tissue; therefore, possibility of viral transmission through milk exists, without ruling out other mechanisms of infection							
18[68]	March 2020	USA	Letter, annotation	NA	NA	NA	NA
More balanced position compared to Mirelly's publication, reports agreement with sample handling.							
19[57]	May 2020	Canada	Systematic review on the processes of HM pasteurization		Systematic review Taxonomic description of viral infection HM; synonyms and HM concepts; pasteurization and HM	Literature review and recommendations in MEDLINE, Embase and gray literature.Articles published until April 2020	Qualitative studies, evaluation of viral load after the pasteurization process, or live viruses detected
The review included 108 articles. Examines the experience with the pasteurization method in relation to the variety of viruses found in HM; presents data of different temperature values evaluated in HM; studies that assess viral tests in HM and other arrays. The Holder method of pasteurization (62.5º for 30') has the largest body evidence in the published literature. There are different methods and techniques, making comparison of results difficult. A single investigator conducted the study, and there is a risk of bias.							
20[32]	May 2020	Italy	Letter, annotation	NA	NA	NA	NA
Discusses the possibility of using different methods for cleaning containers. Discusses the experience in Rome, which is different from that in Milan. The cost of using hypochlorite is much lower when compared to other disinfectants.							
21[38]	March 2020	China	Evaluate the presence of the SARS-Cov-2 virus in different media and physical conditions.	NA	Detection of the presence of the SARS-Cov-2 virus in different media and physical conditions by means of RT-PCR. Letter to the editor	Report	Presence of the virus by culture medium and RT-PCR
The virus is stable in favorable media, but sensitive to disinfection methods.							
22[39]	May 2020	Italy	Evaluate the Holder pasteurization process (HoP) against the high-temperature short-time (HTST) and high pressure (HPP) techniques in relation to the conservation of the bioactive elements of HM	Technical report	Technical laboratory evaluation of milk samples	Comparison of quality indicators for biological protection activity of breast milk (lactoferrin, Ig A) based on the HoP method versus the other two methods studied	The report presents the results for lactoferrin and Ig A levels in different pasteurization media
Decreased levels of lactoferrin and Ig A were found in both pasteurization methods, but at different levels, when compared to the HoP technique. IgA levels are conserved in HTST and reduced in HPP, lactoferrin decreases in HTST, and is maintained in HPP. The three methods reported adequate bacteriological control according to the technical standards for HMB.							

*Main findings and topics discussed in the reviewed articles.

NA: Non-applicable; CR: Clinical record; CMV: Cytomegalovirus; HMB: Human milk bank; NB: newborn; NU: neonatal units; BF: breastfeeding; BM: breast milk; HM: human milk.

Of the 22 documents selected, three described measures related to donor care and sample handling in the current pandemic[27–29]. Seven were opinion postings and letters to the editor expressing different positions on HMBs and the measures adopted based on experience[19, 29-34]. Eleven were reports on technical aspects of biological processes in human milk banks[17,23,24,36–43], and one publication was a systematic review of the evidence on pasteurization and sterilization methods in milk banks in relation to viral infections[44].

The systematic review of 23,441 citations was conducted by a single author and 108 articles were finally included in the selection process. The articles discuss different pasteurization methodologies and tests carried out on human and non-human milk, including tests for assessing the presence of viruses. Evidence on the variations of the different pasteurization methods used in milk banks for viral infections as compared to the Holder process was presented[44].

The technical reports consisted of laboratory analyses pertaining to the evaluation of SARS virus in human milk, and pasteurization methods[13,17,23,24,27,38,40–42,45]. The letters to the editor referred to different aspects of human milk bank management [15,19,31–33,46].

Donor recruitment, selection and accompaniment processes

The information reported recommends restricting accompaniment of the donor[33,47], and assessing her health status[13] as essential practices in the face of the pandemic. Other recommendations include cleaning practices[14,28,29] and milk extraction in the collection center[33]. Donor assessment and container hygiene before and after use are emphasized[17,28].

Extraction and use of collected milk

Protection barriers against SARS-Cov-2 transmission are presented as crucial measures during milk extraction and conservation. The use of homologous milk from healthy donors, ideally unpasteurized, is recommended. If there is restriction due to suspicion or illness in the mother, the use of heterologous donor pasteurized milk is recommended[31,33]. This information is derived from the processes implemented in the countries that published their experiences.

Milk transport and Storage in HMBs

No additional information was found apart from the document of the Colombian Ministry of Health and Social Protection[17].

Vertical transmission

Based on the evidence of vertical HIV transmission in HM[48], the presence of MERS-CoV in milk was evaluated in other mammals during the 2012 epidemic in the Middle East, but no clear answer regarding the mode of transmission was obtained[24].

As to the current pandemic, one report offers evidence of SARS-CoV-2 RNA in a sample of HM extracted during the convalescence period of a woman and her child affected by COVID-19, but does not clarifying the form of contagion in the child[45]. Assessment of other bodily fluids in puerperal women with SARS-CoV-2 / COVID-19 did not demonstrate the presence of infection[49].

Pasteurization

One paper evaluated the literature on the effect of thermal pasteurization on viral load and survival of SARS-CoV-2 in human milk. It discusses various technical variations of pasteurization as compared to the Holder method and their potential impact on milk sterilization and viral load, focusing on the issue of viral transmission[44].

DISCUSSION

This review shows the changes and adaptations implemented in milk banks during the current SARS-CoV-2 / COVID-19 pandemic in terms of donor selection and assessment, the role of HMBs in premature infants, the importance of defining the use of autologous or heterologous milk to preserve not only the nutritional but also the biological qualities of human milk in this population.

Given the complexity of this particular issue, a global initiative was developed to share information about HMB management in the face of the current pandemic, taking into account the wide range of knowledge, concepts, and experiences, in order to arrive at unified criteria[15].

With the evidence of HIV transmission in HM[48,50], pasteurization processes and handling of samples in

HMBs became relevant. Faced with the possibility of viral transmission in milk, experiences with coronavirus-related respiratory epidemics in 2002 showed that viral transmission occurs mainly through inhaled particles or physical contact with surfaces[51]. In 2012, the possibility of transfer of the coronavirus that caused the MERS epidemic [24] through fluids such as milk was suspected. Consequently, mammalian milks subjected to different temperatures were analyzed, demonstrating the usefulness of pasteurization in reducing viral load.

Considering the potential risk of SARS-CoV-2 / COVID-19 infection in bodily fluids, [41] its detection is considered important as part of HMB management. One report shows the presence of the virus identified by Rt-qPCR SARS-CoV-2 in samples from isolated cases, but without clarifying the form of contagion[45]. Likewise, the presence of IgG and IgM immunoglobulins against SARS-CoV-2 / COVID-19 has been reported in neonates only hours old, but not so in the HM given to those neonates, suggesting the possibility of undetectable viral load titers in secreted breast milk[52].

A review of viral transmission of SARS-CoV-2 / COVID-19 in HM[40] did not report evidence of transmission; likewise, reports on the care of pregnant women at the beginning of the SARS- CoV-2 / COVID-19 pandemic in China[53] did not describe vertical viral transmission in newborns. It is essential to take into account that SARS-CoV-2 is an encapsulated RNA virus that requires the ACE-2 receptor to enter cells and cause COVID-19, and that this receptor is present in mammary tissue[40].

Until the time of this review, no conclusive evidence had been reported on the risk of direct viral transmission in human milk[24,41,52].

There are different opinions regarding DHM in premature infants and the pasteurization process. HM offers benefits due to its non-nutritional and nutritional bioactive compounds. Holder (HoP) pasteurization is the international standardized method with the largest body of evidence regarding viral and bacterial biological control most commonly used in HMBs. However, biological protection is diminished as a result of the pasteurization process[20] which induces changes in the chemical composition of HM proteins[37], mainly those with biological anti-infectious immune properties such as immunoglobulins, lactoferrin, and proteins with enzymatic properties (lipoproteins), even though the nutritional composition is maintained[20].

Because of the importance of non-nutritional bioactive factors in premature infants, active research focusing on different pasteurization methods compared to the HoP standard has been carried out over the past decade. However, the variability in the equipment, the technical reports[18,20,54,55], and the tests carried out under technical conditions in research laboratories, both in human and mammalian milk, results in variability in terms of final conclusions regarding the selection of one method over another[37].

So far, the methods that could offer advantages when compared to HoP are flash pasteurization or HTST (high-temperature short-time)[56] and high-pressure process (HPP)[57]. They show less variability and improved conservation of non-nutritional bioactive factors of HM for immune response and infection control activity[30,39,44,55,56]. The commercial availability of these kits for use in HMB is limited, resulting in limited evidence regarding their use in HMBs.

Considering that the primary role of HMBs is to ensure availability of HM for premature infants through DHM, the circumstances of the current pandemic pose a significant risk to donor supply[58]. Consequently, active strategies need to be developed in each region in order to mitigate potential donor shortages, given not only the severe immediate consequences for a vulnerable population such as premature newborns, but also the expected longer term social and economic repercussions[59–61].

The health status of donor women must be proactively ensured[14] as the primary measure of protection against infection, and emphasis needs to be placed on the use of autologous HM. However, if donor conditions do not allow it, the use of PHM is accepted by WHO / UNICEF.

Although no conclusive evidence is available to date regarding SARS-CoV-2 transmission through milk[15,38,45], the use of pasteurized human milk is recommended in cases of suspected infection. This is a sensible approach exclusively for premature babies, considered a vulnerable population in this pandemic[60-65], in order not to limit the use of non-pasteurized HM and offer not only the nutritional but also the biological benefits to this population. Consequently, each case must be evaluated on an individual basis in order to ensure maximum benefit.

Suggestions to help prevent SARS-CoV-2 / COVID-19 transmission can be made on the basis of the technical guidelines proposed by the Colombian Ministry

Table 3. Comparison between the technical guidelines of the Ministry of Health and findings in the literature

Current document of the Colombian Ministry of Health[17]	Proposal based on the findings of the literature search
Donor recruitment, selection and accompaniment processes	
May be accompanied	Restriction of accompaniment by a relative[33.47]
Assessment of the mother's health status	Assessment of the mother's health status: examination protocol and completion of questionnaire to assess the risk of infection; if needed, draw a blood sample required to assess for SARS-Cov-2 infection[13]
Cleaning practices: hand washing, use of cap, mask and coat.	Cleaning practices: hand washing, use of cap, mask and coat[15,27-29]
Expressing milk at home or outside the human milk bank area	Autologous milk extraction to be carried out whenever possible at the milk bank collection center[33], accepting pasteurized heterologous human milk[33]. The use of donations to be deferred until results come back, if infection is suspected[31]
Donor assessment	Donor assessment: classification according to the risk of infection. Policies on protection and sample selection must be communicated[27,31]
Extraction and conservation of milk and handling of aliquots and containers	
Collection at home or by home service	The donation of heterologous milk is accepted, determining whether pasteurization is required or not, and following donor assessment[31,33]
Labeling of the bottle with all relevant information	Idem
The characteristics of the containers are maintained: washing, disinfection and sterilization resistant	Idem
Chemically inert for milk transport	Idem
Tight sealed	Idem
Hygiene of the bottle before and after use with sodium hypochlorite 1:10 (0.5%).	Hygiene of the bottle before and after its use with sodium hypochlorite 1:10 (0.5%)[67] or 70% alcohol [28] due to the risk of permanence of the virus on surfaces for an undetermined period of time[38,51]; hence the recommendation of performing this process before handling the product.
It is recommended to store the aliquots in accordance with the HMB-IFF / NT 19.11[28] standard, at a temperature of - 3ºC and to keep them for no more more than six hours before the pasteurization process[17,28]	Idem
Transport and storage of milk in HMBs	
Transport packaging cleaning and disinfection conditions	Idem
Temperature of isothermal boxes of -3ºC, entering temperatures in the temperature log	Idem
Container integrity, compliance with physical conditions	Idem
Labeling with required information, including donor name, date and time of first extraction	Idem
Reception of milk expressed at home or at the HMB	Milk expressed by donors assessed for heterologous and homologous use will be received[13,33]
Cleaning with 70% alcohol, or 1:10 (0.5%) sodium hypochlorite[17].	Cleaning with 70% alcohol, or with 1:10 sodium hypochlorite (0.5%).[67] There is discussion about taking extreme measures to clean the bottle, considering the possibility of the net cost of the products used[68]

of Health and Social Protection and the findings of this literature review. These suggestions can be grouped into three categories: donor recruitment; milk extraction and conservation, and handling of aliquots and containers; and milk pasteurization at HMBs. A comparative summary of the Ministry's guidelines and the proposal derived from the findings of the literature is shown in Table 3.

It is essential to consider that all this information is continuously changing as new evidence becomes available. Therefore, what is expressed in this document calls for constant reassessment of institutional approaches to the operation of HMBs in accordance with their technical, administrative and financial circumstances. Improved preventive practices should be adopted with the aim of reducing the risk of contagion by SARS-CoV-2 / COVID-19 for donors, operators and end users, i.e., newborn babies. This information also contributes to one of the main roles of HMBs which is to support breastfeeding.

CONCLUSION

There is no evidence to date of vertical transmission of SARS-CoV-2. In cases of premature neonates, maternal health status must be assessed for the use of autologous HM. Likewise, the health of donor women must also be assessed before obtaining DHM. Personal protection of HMB staff must be reinforced in order to ensure their safety and the safe handling of aliquots for use in premature newborns. Finally, strategies for active breastfeeding promotion must be developed in all communities with access to HMBs.

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Conflict of interest

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Authorship statement

AJO: Search, Collection, literature evaluation, creation of the manuscript. FSM: Critical evaluation of the articles. Development and evaluation of the paper. RSL, CDL, NCL, IRH, DAPR: Literature search, article evaluations. All authors reviewed the manuscript and validated its final version.

References

1. Adhikari SP, Meng S, Wu Y-J, Mao Y-P, Ye R-X, Wang Q-Z, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. Infect Dis Poverty. 2020;9: 29. doi: https://doi.org/10.1186/s40249-020-00646-x.
2. COVID-19 Host Genetics Initiative. The COVID-19 Host Genetics Initiative, a global initiative to elucidate the role of host genetic factors in susceptibility and severity of the SARS-CoV-2 virus pandemic. Eur J Hum Genet. 2020;28(6):715-8. doi: https://doi.org/10.1038/s41431-020-0636-6.
3. Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. Lancet. 2020;395(10224):565-74. doi: https://doi.org/10.1016/S0140-6736(20)30251-8.
4. Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et al. The species Severe acute respiratory syndrome- related coronavirus : classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol. 2020: 536-544. doi: https://doi.org/10.1038/s41564-020-0695-z.
5. Jiang S, Shi Z, Shu Y, Song J, Gao GF, Tan W, et al. A distinct name is needed for the new coronavirus. Lancet. 2020; 395(10228): 949. doi: https://doi.org/10.1016/S0140-6736(20)30419-0.
6. World Health Organization (WHO). Naming the coronavirus disease (COVID-19) and the virus that causes it [Internet]. WHO; 2020 [citado 2 de abril de 2020]. Disponible en: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it.
7. Rabi FA, Al Zoubi MS, Kasasbeh GA, Salameh DM, Al-Nasser AD. SARS-CoV-2 and Coronavirus Disease 2019: What we know so far. Pathogens. 2020;9(3):231. doi: https://doi.org/10.3390/pathogens9030231.
8. Cui J, Li F, Shi Z-L. Origin and evolution of pathogenic coronaviruses. Nat Rev Microbiol. 2019;17(3):181-92. doi: http://dx.doi.org/10.1038/s41579-018-0118-9.

9. Guan W-J, Liang W-H, Zhao Y, Liang H-R, Chen Z-S, Li Y-M, et al. Comorbidity and its impact on 1590 patients with Covid-19 in China: A nationwide analysis. Eur Respir J. 2020;55(5): 2000547. doi: https://doi.org/10.1183/13993003.00547-2020.
10. The Lancet. Redefining vulnerability in the era of COVID-19. Lancet. 2020;395(10230):1089. doi: http://dx.doi.org/10.1016/S0140-6736(20)30757-1.
11. Center for Disease Control and Prevention (CDC). People at Higher Risk for Severe Illness. People with certain medical conditions [Internet].CDC; August 14, 2020 [citado 2 de junio de 2020]. Disponible en: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/groups-at-higher-risk.html.
12. BBC. Coronavirus confirmed as pandemic by World Health Organization. [Internet]. 11 de marzo de 2020 [Fecha de consulta: Mayo 25 2020]. Disponible en: https://www.bbc.com/news/world-51839944.
13. 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. doi: http://dx.doi.org/10.1111/mcn.13010.
14. Centers for Disease Control and Prevention (CDC). Safety in Maternity Care [Internet]. CDC; January 5th, 2020 [citado 10 de mayo de 2020]. Disponible en: https://www.cdc.gov/breastfeeding/recommendations/safety-in-maternity-care.html.
15. Shenker N, Virtual Collaborative Network of Human Milk Banks and Associations. Maintaining safety and service provision in human milk banking: a call to action in response to the COVID-19 pandemic. Lancet Child Adolesc Health. 2020;4(7):484-85. doi: http://dx.doi.org/10.1016/S2352-4642(20)30134-6.
16. Ministerio de Salud. Banco de Leche humana en Colombia [Internet]. [Fecha de consulta 2 de junio de 2020]. Disponible en: https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/PP/SNA/donacion-bancos-de-leche-humana-mayo-2015.pdf.
17. Dirección de Promoción y Prevención.Subdirección de Salud Nutricional, Alimentos y Bebidas. Lineamientos Técnicos para la Estrategia de Bancos de Leche Humana en Colombia Dirección de Promoción y Prevención [Internet]. Ministerios de Salud y Protección Social; Marzo de 2019. [Fecha de consulta: Marzo 20 2020]. Disponible en: https://actualisalud.com/wp-content/uploads/2019/03/Lineamientos-técnicos-banco-de-leche-humana.pdf.
18. Peila C, Moro GE, Bertino E, Cavallarin L, Giribaldi M, Giuliani F, et al. The effect of holder pasteurization on nutrients and biologically-active components in donor human milk: A review. Nutrients. 2016;8(8):477. doi: https://doi.org/10.3390/nu8080477.
19. Marinelli KA. International Perspectives Concerning Donor Milk Banking During the SARS-CoV-2 (COVID-19) Pandemic. J Hum Lact. 2020;36(3):492-97. doi: https://doi.org/10.1177/0890334420917661.
20. Peila C, Emmerik NE, Giribaldi M, Stahl B, Ruitenberg JE, van Elburg RM, et al. Human milk processing: A systematic review of innovative techniques to ensure the safety and quality of donor milk. J Pediatr Gastroenterol Nutr. 2017;64(3):353-61. doi: https://doi.org/10.1097/MPG.0000000000001435.
21. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Med Res Methodol. 2018;18(1):143. doi: https://doi.org/10.1186/s12874-018-0611-x.
22. Joanna Briggs Institute. Apprais tools use JBI Syst Rev [Internet]. 2017;1-7. [Fecha de consulta: 2 de junio 2020] Disponible en: https://joannabriggs.org/ebp/critical_appraisal_tools.htlm.
23. Clarke NM. May JT. Effect of antimicrobial factors in human milk on rhinoviruses and milk born cytomegalovirus in vitro. J Med Microbiol. 2000;49(8):719-23. doi: https://doi.org/10.1099/0022-1317-49-8-719.
24. van Doremalen N, Bushmaker T, Karesh WB, Munster VJ. Stability of middle east respiratory syndrome coronavirus in milk. Emerg Infect Dis. 2014;20(7):1263-4. doi: https://doi.org/10.3201/eid2007.140500.
25. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ. 2009;339: b2700. doi: https://doi.org/10.1136/bmj.b2700.
26. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. Ann Intern Med. 2018;169(7):467-73. doi: https://doi.org/10.7326/M18-0850.
27. European Milk Bank Association (EMBA). COVID-19: EMBA Position Statement. [Internet]. EMBA; February 25th, 2020. [Fecha de consulta: 11 de mayo de 2020]. Disponible en: https://europeanmilkbanking.com/covid-19-emba-position-statement/.
28. Rede Global de Bancos de Leite Humano. Rede Ibero-americana enfrentando o COVID-19: Boas Práticas em Bancos de Leite Humano [Internet]. rBLH Brasil. 2020 [Fecha de consulta: 15 de mayo de 2020]. Disponible en: https://rblh.fiocruz.br/rede-ibero-americana-enfrentando-o-covid-19-boas-praticas-em-banco-de-leite-humano.
29. World Health Organization (WHO). Infection prevention and control during health care when COVID-19 is suspected: interim guidance [Internet]. World Health Organization; 2020. [Fecha de consulta: 2 de junio de 2020]. Disponible en: https://apps.who.int/iris/handle/10665/331495.
30. Kleist SA, Knoop KA. Understanding the Elements of Maternal protection from Systemic Bacterial Infections during Early Life. Nutrients. 2020; 14(12): 1045; doi: https://doi.org/10.3390/nul12041045.

31. Jayagobi PA, Mei Chien C. Maintaining a Viable Donor Milk Supply During the SARS-CoV-2 (COVID-19) Pandemic. J Hum Lact. 2020. doi: https://doi.org/10.1177/0890334420931828.
32. De Rose DU, Reposi MP, Amadio P, Auriti C, Dall'Oglio I, Corsetti T, et al. Use of Disinfectant Wipes to Sanitize Milk's Containers of Human Milk Bank During COVID-19 Pandemic. J Hum Lact. 2020;36(3): 547-49. doi: https://doi.org/10.1177/0890334420924639.
33. Furlow B. US NICUs and donor milk banks brace for COVID-19. Lancet Child Adolesc Health. 2020;4(5):355. doi: https://doi.org/10.1016/S2352-4642(20)30103-6.
34. HMBANA.org. Milk Banling and COVID 19 [Internet]. [citado 15 de mayo de 2020]. p. 1-3. Disponible en: https://www.texasmilkbank.org/.
35. Berveiller P, Guerby P, Garabedian C. COVID19 and Breastfeeding: Not That Simple. J Hum Lact. 2020;36(2): 369-70. doi: https://doi.org/10.1177/0890334420917102.
36. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect. 2020;104(3):246-51. doi: https://doi.org/10.1016/j.jhin.2020.01.022.
37. Wesolowska A, Sinkiewicz-Darol E, Barbarska O, Bernatowicz-Lojko U, Borszewska-Kornacka MK, van Goudoever JB. Innovative techniques of processing human milk to preserve key components. Nutrients. 2019;11(5):1169. doi: https://doi.org/10.3390/nu11051169.
38. Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen H-L, Chan MCW, et al. Stability of SARS-CoV-2 in different environmental conditions. Lancet Microbe. 2020;1(1):e10. doi: https://doi.org/10.1016/S2666-5247(20)30003-3.
39. Aceti A, Cavallarin L, Martini S, Giribaldi M, Vitali F, Ambretti S, Zambrini V, et al. Effect of alternative pasteurization techniques on human milk's bioactive proteins. J Pediatr Gastroenterol Nutr. 2020;70(4):508-12. doi: https://doi.org/10.1097/MPG.0000000000002598.
40. Lackey K, Pace R, Willams J, Bode L, Donovan Sh, Järvinen K, Seppo A, Raiten D, Meeham C, McGuire M MGM. SARS-Co-V -2 and human milk: what is the evidence? MdedRxiv. 2020;1-22.
41. Pan Y, Zhang D, Yang P, Poon LLM, Wang Q. Viral load of SARS-CoV-2 in clinical samples. Lancet Infect Dis. 2020;20(4):411-12. doi: http://dx.doi.org/10.1016/S1473-3099(20)30113-4.
42. Darnell MER, Taylor DR. Evaluation of inactivation methods for severe acute respiratory syndrome coronavirus in noncellular blood products. Transfusion. 2006;46(10):1770-7. doi: https://doi.org/10.1111/j.1537-2995.2006.00976.x.
43. Gayà A, Calvo J. Improving pasteurization to preserve the biological components of donated human milk. Front Pediatr. 2018;6: 288. doi: https://doi.org/10.3389/fped.2018.00288.
44. Pitino MA, O´Connor DL, Mcgeer AJ, Unger S. The impact of thermal pasteurization on viral load in human milk and other matrices : A rapid review. Appl Physiol Nutr Metab. 2020. doi: https://doi.org/10.1139/apnm-2020-0388.
45. Groß R, Conzelmann C, Müller JA, Stenger S, Steinhart K, Kirchhoff F, et al. Detection of SARS-CoV-2 in human breastmilk. Lancet. 2020; 395(10239). doi: https://doi.org/10.1016/S0140-6736(20)31181-8.
46. 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):213-16. doi: https://doi.org/10.1177/0890334420927329.
47. Bar-Yam N. Important Milk Bank COVID-19 Update [Internet]. Mothers´Milk Bank Northeast;2020 [Fecha de consulta: 2 de junio de 2020]. Disponible en: https://milkbankne.org/2020/04/milk-bank-covid-19-update/.
48. Black RF. Transmission of HIV-1 in the breast feeding process. J Am Diet Assoc. 1996;96(3):267-74. doi: https://doi.org/10.1016/S0002-8223(96)00079-X.
49. Chen H, Guo J, Wang C, Luo F, Yu X, Zhang W, 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. doi: http://dx.doi.org/10.1016/S0140-6736(20)30360-3.
50. Dunn DT, Newell ML, Ades AE, Peckham CS. Risk of human immunodeficiency virus type 1 transmission through breastfeeding. Lancet. 1992;340(8819):585-88.doi: https://doi.org/10.1016/0140-6736(92)92115-V.
51. Rabenau HF, Cinatl J, Morgenstern B, Bauer G, Preiser W, Doerr HW. Stability and inactivation of SARS coronavirus. Med Microbiol Immunol. 2005;194(1):1-6. doi: https://doi.org/10.1007/s00430-004-0219-0.
52. Dong L, Tian J, He S, Zhu C, Wang J, Liu C, et al. Possible Vertical Transmission of SARS-CoV-2 from an Infected Mother to Her Newborn. JAMA. 2020;323(18):1846-48. doi: https://doi.org/10.1001/jama.2020.4621.
53. Yan J, Guo J, Fan C, Juan J, Yu X, Li J, et al. Coronavirus disease 2019 in pregnant women: a report based on 116 cases. Am J Obstet Gynecol. 2020; 223(1): 111.e1-111.e14. doi: https://doi.org/10.1016/j.ajog.2020.04.014.
54. Li Y, Nguyen DN, de Waard M, Christensen L, Zhou P, Jiang P, et al. Pasteurization Procedures for Donor Human Milk Affect Body Growth, Intestinal Structure, and Resistance against Bacterial Infections in Preterm Pigs. J Nutr. 2017;147(6):1121-30. doi: https://doi.org/10.3945/jn.116.244822.
55. Schlotterer HR, Perrin MT. Effects of Refrigerated and Frozen Storage on Holder-Pasteurized Donor Human Milk: A Systematic Review. Breastfeed Med. 2018;13(7):465-72.doi: https://doi.org/10.1089/bfm.2018.0135.
56. Escuder-Vieco D, Espinosa-Martos I, Rodríguez JM, Corzo N, Montilla A, Siegfried P, et al. High-temperature short-time pasteurization system for donor milk in a human milk bank setting. Front Microbiol. 2018;9: 926. doi: https://doi.org/10.3389/fmicb.2018.00926.

57. Pitino MA, Unger S, Doyen A, Pouliot Y, Aufreiter S, Stone D, et al. High hydrostatic pressure processing better preserves the nutrient and bioactive compound composition of human donor milk. J Nutr. 2019;149(3):497-504. doi: https://doi.org/10.1093/jn/nxy302.

58. Williams J, Namazova-Baranova L, Weber M, Vural M, Mestrovic J, Carrasco-Sanz A, et al. The importance of continuing breastfeeding during COVID-19: in support to the WHO statement on breastfeeding during the pandemic. J Pediatr. 2020; 223: 234-236. doi: https://doi.org/10.1016/j.jpeds.2020.05.009.

59. Pérez-Escamilla R, Cunningham K, Moran VH. COVID-19, food and nutrition insecurity and the wellbeing of children, pregnant and lactating women: A complex syndemic. Matern Child Nutr. 2020 Jul;16(3):e13036. doi: https://doi.org/10.1111/mcn.13036.

60. Menendez C, Gonzalez R, Donnay F, Leke RGF. Avoiding indirect effects of COVID-19 on maternal and child health. Lancet Glob Health. 2020; 8(7): e863-e864. doi: http://dx.doi.org/10.1016/S2214-109X(20)30239-4.

61. Fore HH. A wake-up call : COVID-19 and its impact on children's health and wellbeing. Lancet Glob Health. 2020;8(7):e861-e862. doi: http://dx.doi.org/10.1016/S2214-109X(20)30238-2.

62. Moro GE, Billeaud C, Rachel B, Calvo J, Cavallarin L, Christen L, et al. Processing of donor human milk: Update and recommendations from the European Milk Bank Association (EMBA). Front Pediatr. 2019;7: 49. doi: http://dx.doi.org/10.3389/fped.2019.00049.

63. World Health Organization (WHO). COVID-19 and breastfeeding. Position paper. [Internet]: WHO, Regional office for Europe; 2020 [Fecha de consulta: 25 de mayo de 2020]. Disponible en: https://www.euro.who.int/__data/assets/pdf_file/0010/437788/breastfeeding-COVID-19.pdf?ua=1.

64. PATH. Policy Brief: Ensuring equitable access to human milk for all infants A comprehensive approach to essential newborn care [Internet]. Seattle: PATH; 2017 [Fecha de consulta: 4 de abril 2020]. Disponible en: https://www.who.int/nutrition/publications/infantfeeding/equitable-access-human-milk-policybrief/en/.

65. UNICEF. UNICEF position regarding close contact and breastfeeding in COVID-19 context [Internet]. 2020 [Fecha de consulta: 10 de mayo de 2020]. Disponible en: https://www.unicef.org/romania/press-releases/unicef-position-regarding-close-contact-and-breastfeeding-covid-19-context#:~:text=In%20the%20context%20of%20COVID19,age%20and%20beyond)%2C%20but%20they.

66. UNICEF. Breastfeeding safely during the COVID-19 pandemic [Internet]. May 28, 2020 [Fecha de consulta: 1 de junio de 2020]. Disponible en: https://www.unicef.org/coronavirus/breastfeeding-safely-during-covid-19-pandemic.

67. Marinelli KA, Lawrence RM. Safe Handling of Containers of Expressed Human Milk in all Settings During the SARS-CoV-2 (COVID-19) Pandemic. J Hum Lact. 2020;00(0):1-4. doi: https://doi.org/10.1177/0890334420919083.

68. Stellwagen L, Chambers C. Response to: Safe Handling of Containers of Expressed Human Milk in all Settings During the SARS-CoV-2 (COVID-19) Pandemic (Marinelli and Lawrence, 2020). J Hum Lact. 2020;36(3):541. doi: https://doi.org/10.1177/0890334420923364.