



## **Recommendations for breastfeeding during maternal infections**

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### **Abstract**

**Objective:** To make a literature review on breastfeeding and maternal infectious diseases in order to contribute with knowledge and information that can aid the pediatrician to decide upon allowing infected mothers to breastfeed their babies or not.

**Sources of data:** Lilacs and MEDLINE databases were searched for books, technical rules and articles on the issue of breastfeeding and infected mothers.

**Summary of the findings:** Infected lactating mothers can transmit pathogenic agents to their infants. Although breastfeeding protects the child it can also be a dangerous source of infection. Maternal diseases caused by bacteria, virus, fungi and parasites may sometimes be transmitted via human milk. The literature points out that mothers infected with HIV and T-lymphotropic human viruses (type I) should not breastfeed. With other diseases a careful approach should be made, but, in general, breastfeeding is maintained.

**Conclusion:** The mother who is exposed to infectious diseases may transmit pathogenic agents through the human milk, attention should also be made to milk from milk banks. The healthcare provider must take his/her decision upon suspending breastfeeding - or not, what can be distressful, once he/she has a fundamental role in promoting and stimulating breastfeeding.

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### **Introduction**

Human milk, in addition to its nutritional components, contains numerous cells, membranes and molecules whose function is to protect newborn infants. In lactating women, the enteromammary or bronchomammary immune system is activated when pathogens (bacteria) come in contact with the mucous membranes of the intestine or respiratory tract and are phagocytosed by macrophages. This stimulates T lymphocytes, causing the differentiation of immunoglobulin

A (IgA)-producing B lymphocytes. Lymphocytes migrate to the mammary gland and, mediated by cytokines, turn into plasma cells that produce a glycoprotein, which binds to IgA, and eventually turns into secretory immunoglobulin A (sIgA). This is an important and specific protective function of human milk in newborns.<sup>1-5</sup>

Breastfeeding, given its benefits to mother and infant, is considered to be the best form of nutrition for infants. However, maternal and infant diseases may hinder breastfeeding. Under these circumstances, the health professional should be skilled, have technical knowledge and adopt a favorable attitude so as to properly assess the viability of breastfeeding. When the nursing mother presents with the symptoms of a disease, she has already exposed her infant to the pathogen and the usual recommendation is that breastfeeding should be maintained.<sup>6-9</sup> If the mother discontinues breastfeeding after symptom onset, infant protection against diseases is decreased, and the chances of the infant falling ill are increased, since he/she is not provided with specific antibodies and other protective factors from human milk.

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No recommendation to discontinue breastfeeding, even if temporarily, exists in cases of mothers with urinary tract infection, bacterial infection of the abdominal wall, episiorrhaphy, mastitis or any other disease in which the nursing mother's physical conditions and general state of health are not so compromised.

Although human milk contains antibodies, mononuclear cells and other protective factors, it may be a possible source of infection for the infant in some maternal diseases.<sup>6,7</sup> The mononuclear cells in human milk, albeit providing protection, may transfer infectious particles from the mother to the infant. Thus, when health professionals attend to a nursing mother with active viral infection or another infectious disease, they may become uncomfortable about whether they should discontinue or not breastfeeding, as their role is to promote and encourage it.

Some infectious diseases may impede breastfeeding, either on a temporary or permanent basis, due to maternal physical conditions such as severe cardiac, renal, and hepatic diseases, psychosis and severe postpartum depression.<sup>10</sup>

In the present review, we discuss breastfeeding management in the presence of common maternal diseases caused by bacteria, viruses, parasites and fungi.

### **Viral infections**

In several maternal viral diseases, such as hepatitis, herpes, measles, mumps and rubella, among others, the virus may be excreted into human milk. However, except for infections caused by retroviruses, human immunodeficiency virus (HIV-1), human T-lymphotropic virus type I (HTLV I) and human T-lymphotropic virus type II (HTLV II), transmission via human milk has little epidemiological relevance. In most maternal viral

diseases, other sources of contamination of newborns should be considered before ascribing the cause to breastfeeding only. The risk of transmission may be enhanced in cases of acute infection at delivery, as the milk may contain a high concentration of viral particles and low titers of protective antibodies able to neutralize the infectious agent. Therefore, in general, there is no formal contraindication for breastfeeding in most cases of viral diseases, except for diseases caused by retroviruses.

The transmission of RNA retrovirus, including HIV-1,<sup>11,12</sup> HTLV I and HTLV II<sup>13</sup> has already been demonstrated. HIV-2 can also be transmitted from mother to infant, but the role of breastfeeding in the transmission via human milk has not been clearly established yet. The Epstein-Barr virus and herpesvirus 6 can be found in human milk, but so far, reports on breastfed infants infected by these viruses have been few and far between. To some extent, the fact that breastmilk is not much more infectious is surprising, especially due to the daily volume ingested by exclusively breastfed infants. Supposedly, there may be other protective factors than those widely known.

Table 1 summarizes the most important infections, with possible transmission of the virus to the infant via breastmilk, and the corresponding breastfeeding management.

### **HIV infection**

HIV is excreted freely or into cells in the milk of infected women, who may or may not present with symptoms of the disease. Approximately 65% of vertical HIV transmission occurs during labor and during delivery; the remaining 35% occurs in utero, mainly within the last weeks of gestation and via breastfeeding. The viral load in breastmilk is an important determinant for the risk of

**Table 1 -** Maternal viral infections and the corresponding breastfeeding management

<b>Type of virus</b>	<b>Recommendation</b>
Cytomegalovirus	Breastfeeding
Hepatitis A*	Breastfeeding
Hepatitis B	Breastfeeding
Hepatitis C*	Breastfeeding
Rubella	Breastfeeding
Mumps	Breastfeeding
Simple herpes	Breastfeeding, except if there are lesions on the breasts
Varicella	Breastfeeding, except if the infection was acquired between 5 days before the delivery and 3 days after the delivery
Measles	Temporary interruption of breastfeeding
HTLV I	No breastfeeding
HIV	No breastfeeding

\* See comments in the text.

transmission.<sup>14-16</sup> In newborns, the virus penetrates the nasopharyngeal and gastrointestinal mucosae. During breastfeeding, viral transmission may occur at any stage, but it seems to occur more often within the first weeks and especially in most recent maternal infections. The viral load in colostrum is significantly higher than in mature milk. Mixed breastfeeding seems to pose more risks than exclusive breastfeeding, due to the major injury to the gastrointestinal mucosa resulting from artificial feeding, which favors the penetration of the virus.<sup>17</sup> The additional risk of transmission of the virus via human milk ranges from 5 to 20%.<sup>18</sup> Contamination via breastmilk in women who acquired the infection after the postnatal period was detected in 29% (15-53%) of cases.<sup>10,16,18</sup> The presence of HIV-infected cells in breastmilk for over 15 days after delivery is an important predictive factor for infection in the infant.<sup>17</sup>

Retroviruses can infect mammary epithelial cells before delivery, and can be found free or infecting monocytes in milk, which account for 50% of cells found in breastmilk. These cells can potentially carry the virus from the maternal bloodstream or from lymphoid tissues to the infant's intestine. Some types of HIV use chymosin receptors to infect macrophages. However, more studies are necessary to accurately define the role of human milk cells in HIV infection.<sup>19-21</sup>

The use of antiretroviral therapy during pregnancy and delivery and its maintenance in newborns results in a decrease in vertical HIV transmission for up to six months after childbirth,<sup>22</sup> even if breastfeeding is maintained. Nevertheless, HIV infection is one of the few situations in which the contraindication for breastfeeding is a common agreement. In Brazil, The Ministry of Health<sup>23</sup> recommends that HIV-infected mothers should not breastfeed. On the other hand, the World Health Organization and UNICEF recommend that, in poor countries, where diseases such as diarrhea, pneumonia and malnutrition substantially contribute to high rates of infant morbidity and mortality, the benefits of breastfeeding should be considered in relation to the risk of HIV transmission. In these cases, and if it is not possible to provide appropriate artificial feeding, breastfeeding should be maintained, given its benefits to infants who live in precarious conditions.<sup>15,24,25</sup> Women who receive combined antiretroviral therapy have lower rates of viral transmission.<sup>22</sup> Preliminary information obtained from a study conducted in South Africa considers that it is possible to reduce or prevent the risk of postnatal transmission of HIV if the infant receives human milk for a short period of time.<sup>14</sup> The idea is to maintain breastfeeding for four to six months. However, the efficacy and safety of such practice has not been demonstrated yet, and studies still have been underway.

Another alternative is to reduce or eliminate HIV from human milk. Infected cells can be removed from milk, but viral particles are difficult to eliminate. The inactivation of HIV in breastmilk through pasteurization (62.5 °C for 30 minutes, followed by rapid cooling) allows infants to continue receiving breastmilk without increasing the postnatal risk of infection.<sup>26,27</sup>

### **HTLV infection**

HTLV belongs to the retrovirus family, the same of HIV. They are human T1 and T2 lymphotropic viruses called HTLV I and HTLV II. Type I causes a rare type of leukemia, myelitis and eye infection that may result in blindness. HTLV II is not associated with disease. They can be transmitted via blood, infected needles, sexual intercourse and from mother to infant by means of breastfeeding. The principal mode of transmission is vertical, but the predominant one is via breastfeeding.

Although HTLV affects a small portion of the population, with possible late development of diseases in only 1 to 4% of infected individuals, its occurrence has increased in South America, especially because of the lack of health surveillance. As the disorders caused by these retroviruses are severe and cannot be treated or controlled with efficient therapy and vaccine, contraindication for breastfeeding in infected women is a major way of reducing their vertical transmission.

In Japan, freezing the milk of HTLV I-positive mothers at -20 °C has been used as a way to inactivate the virus. However, the Center for Disease Control and Prevention (CDC) establishes that every HTLV I-infected mother should be advised not to breastfeed, and does not have an opinion on the freezing of human milk in this situation. CDC considers the current data on HTLV I transmission via frozen and thawed breastmilk to be insufficient.

The amount of HTLV I-infected cells in peripheral blood is very small compared to the number of infected T cells in breastmilk, which explains the high risk of viral transmission via human milk. Some risk factors have been considered in the transmission of HTLV I and II via human milk: breastfeeding for over three months, advanced maternal age, antigen levels in maternal blood and high titers of HTLV I antibodies in the nursing mother.<sup>10,17</sup> However, Van Dyke *et al.*<sup>28</sup> report that the transmission of HTLV II from mother to infant may occur regardless of the type of feeding the infant receives in similar rates to those of HTLV I, thus showing that the virus can be transmitted to the infant in the absence of breastfeeding.

### **Hepatitis A, B and C**

Hepatitis A, B and C viruses can be transmitted to the infant during pregnancy, delivery or postnatal period. Viruses transmitted by the oral-fecal route, as in hepatitis A, have a higher chance of being transmitted to the infant at delivery.

The hepatitis A virus can be excreted into human milk in the acute phase of the disease. When delivery occurs in this phase of the disease, the infant should receive anti-hepatitis A immunoglobulin at the dose of 0.02 ml/kg as prophylactic measure. This prophylaxis is indicated for all infants, regardless of whether they are being breastfed or not, and provides protection that outweighs the risk of the infant acquiring the disease. Thus, breastfeeding is not contraindicated.<sup>7</sup>

Hepatitis B and C viruses are transmitted hematogenously and sexually. Hepatitis B surface antigen (HBsAg) has been

detected in the milk of HBsAg-seropositive women, and possibly, small amounts of blood might be ingested by the newborn infant during breastfeeding, from nipple injuries, even if these injuries are small. However, the major mode of transmission is infant exposure to maternal blood, which occurs throughout labor and delivery.<sup>29</sup>

In case of HBsAg-seropositive mothers during pregnancy, the infant should receive the first dose of the vaccine immediately after delivery and hepatitis B hyperimmune immunoglobulin (0.5 ml IM) in the first 12 hours of life, given concomitantly, but in different sites. This practice has an efficiency of 95% and eliminates the occasional risk of transmission via breastmilk.<sup>7,30</sup>

When the mother has not been tested for HBsAg or if this information is not available, the test should be requested immediately after delivery. While the test result is not available, the newborn should receive the first dose of the vaccine. If the test yields a positive result, immunoglobulin should be given as soon as possible, within the first seven days after delivery. However, if HBsAg testing is not possible, giving all newborns immunoglobulin is not recommended, since the vaccine alone is quite efficient in preventing the disease in 70 to 90% of cases.<sup>7</sup>

In cases of HBsAg-positive mothers, newborns should be thoroughly washed, in order to remove all traces of blood or maternal fluids. Breastfeeding is not contraindicated even if the mother has a bleeding nipple fissure.

The Brazilian Society of Pediatrics recommends that preterm newborns weighing less than 2,000 g born to an HBsAg-positive mother should receive four doses of the vaccine (at birth, at 1, 2 and 6 months of life) besides immunoglobulin.<sup>30</sup> If the first dose is not administered in the neonatal period, then the infant should receive the three conventional doses of the vaccine. In all situations, breastfeeding should be recommended. In mothers with an infant aged less than one year and with hepatitis B diagnosed during the breastfeeding period, breastfeeding should be maintained and the infant should be tested for HBsAg, since he/she received the vaccine at birth. If the result of the test is negative, the infant should be revaccinated and the prophylactic measures for the case should be followed, that is: administer hepatitis B immunoglobulin (HBIG) intramuscularly at the dose of 0.04 ml/kg, or standard gammaglobulin at the dose of 0.12 ml/kg IM.<sup>30,31</sup>

Although hepatitis C virus has been detected in the milk of HCV-positive mothers, its transmission via breastmilk has not been confirmed. Therefore, breastfeeding is not contraindicated in HCV-positive mothers. However, the prevention of nipple fissures is very important, as it has not been yet determined whether the infant's contact with maternal blood can facilitate the transmission of the disease. The American Academy of Pediatrics Committee on Infectious Diseases recommends that mothers be informed of the theoretical (but yet not confirmed) risk of transmitting the virus via breastmilk. The decision to breastfeed should be analyzed on a case-by-case basis, assessing the role of breastfeeding in the infant's life, since the definite role of breastfeeding in the transmission of hepatitis C virus to the infant is not known.<sup>7</sup>

### **Cytomegalovirus infection**

Cytomegalovirus (CMV) can be intermittently excreted in saliva, urine, genital secretions and human milk for several years after the primary infection and in case of reactivation of its latent forms. Infant or fetal infection may be acquired from mothers with primary infection or during reactivation of the infection, occurring more frequently while the baby passes through the birth channel or in the postnatal period. However, due to the transplacental transfer of antibodies, this disease is not common among newborns.

In postnatal infection, the correlation with breastfeeding is evident, although the virus may be acquired from the contact with other seropositive individuals who share the same household. Studies show that 30% of breastfed infants born to seropositive mothers acquire the infection in the first years of life, amounting to 70% of the cases when the virus is isolated in breastmilk. Nevertheless, symptomatic infections or late sequelae have not been observed in babies, possibly due to the transfer of specific maternal antibodies that protect the infant against systemic disease. Early contamination of the breastfed infant seems to be preferred, because if contamination occurs later on, the risk for symptomatic disease is higher. These data confirm that breastfeeding should not be contraindicated.<sup>32,33</sup>

However, special attention should be given to preterm babies, especially those with a lower gestational age. The decision to breastfeed preterm infants of CMV-positive mothers should be considered in terms of risk of transmission of the disease *versus* breastfeeding benefits. Preterm babies might not have protective antibodies and have symptomatic infections. However, the virus can become inactive by pasteurization of human milk and the viral load can be reduced by freezing the milk at -20 °C.<sup>32,33</sup>

A recent study with preterm infants who acquired infection in the early postnatal period, via breastmilk of CMV-positive mothers, has shown that neurological development and hearing were not compromised in the infants. Nevertheless, given the small number of assessed infants, follow-up studies with preterm infants with infections acquired in the postnatal period are necessary.<sup>34</sup>

### **Varicella**

A mother who presents with varicella up to five days before or two days after delivery may transmit the disease to the infant in its severe form, when the risk for viremia is high. In these cases, the mother should be isolated during the contagious phase of lesions up to the crust phase, and VZIG (varicella-zoster immunoglobulin) at the dose of 125 intramuscular units or a 2-ml single IM dose of standard immunoglobulin should be given to the infant as soon as possible, although the value of the latter medication is arguable.<sup>10</sup> The infant should be observed up to the 21st day of life. It is unclear whether the virus can be found in human milk and whether it could infect the infant. Thus, during this period, breastmilk can be expressed and given to the infant. However, if the infant develops the disease during this period, acyclovir therapy should be implemented.<sup>34</sup>

A mother with varicella whose onset of the disease occurred more than five days before delivery or after the third day postpartum can produce and transfer antibodies to the infant, transplacentally or via breastmilk. In this case, the infant may develop the mild form of the disease, with no need for isolation or prophylaxis. The mother can breastfeed the infant, provided that precautions such as handwashing, wearing of a mask and covering of lesions are properly taken.<sup>35</sup>

### **Herpes simplex**

Newborn infants can be contaminated with herpes simplex in utero via a hematogenous transplacental route, during delivery (more frequent) or in the postnatal period. The risk of neonatal contamination is higher for primary infection or non-primary infection if it occurs in the last month of gestation. However, in the last week before delivery, transmission rates are low for recurrent disease.

The risk of viral transmission via breastmilk is very low. In nursing mothers with herpes, breastfeeding should not be interrupted, except when the herpetic vesicles are located on the breasts. Active lesions in other body parts should be covered, and the nursing mother's hygiene should not be overlooked so that breastfeeding can be maintained.

Extra precaution should be taken if vesicles are present on the face and fingers, as well as with other sources of herpes simplex virus, such as gingivostomatitis in other family members. If there is suspicion or confirmation that the infant is infected with herpes simplex, he/she should be isolated from other infants but not from his/her mother. There is a case report of a 15-month-old who was contaminated with the disease by a five-year-old sibling who had gingivostomatitis. Both of the mother's breasts were contaminated by the infant during breastfeeding.<sup>36</sup>

### **Rubella**

Acute exanthematic disease caused by a virus that can be eliminated in respiratory secretions between 10 days before and 15 days after the appearance of the exanthema. Most cases are asymptomatic or subclinical, but may transmit the infection. No data exist that contraindicate breastfeeding in a nursing mother with rubella. In case of vaccination against rubella, breastfeeding may be maintained as well.<sup>10</sup>

### **Measles**

Highly contagious exanthematic disease caused by a virus transmitted by respiratory secretions few days before and during the course of the disease. The measles virus has not been isolated in human milk yet, but, on the other hand, specific antibodies were found in the milk of immunized women. If measles is confirmed in a nursing mother, the infant should receive immunoglobulin, and the mother should be isolated up to 72 hours after the appearance of the exanthema. However, expressed breastmilk can be given to the infant because secretory IgA begins to be secreted after 48 hours of the appearance of the exanthema in the mother.<sup>10</sup>

### **Mumps**

Viral disease transmitted by direct contact with respiratory droplets or fomites. Infection is rare in infants younger than one year due to the passive transfer of antibodies via placenta. If a susceptible nursing mother is infected, she should continue breastfeeding because exposure occurred seven days before the development of parotiditis and IgAs in human milk may help mitigate the symptoms in the infant.<sup>10</sup>

### **Bacterial infections**

#### **Tuberculosis**

Breastfeeding recommendations for mothers with tuberculosis depend on the time at which diagnosis was made. According to the World Health Organization, it is not necessary to separate the mother from the infant and, under no circumstance, should breastfeeding be discontinued.<sup>9,37</sup> Koch's bacillus is exceptionally excreted into breastmilk, and if the infant is infected, the respiratory tract usually serves as a portal of entry. Thus, a mother with extrapulmonary tuberculosis does not require any special care to breastfeed.

According to the American Academy of Pediatrics, an infant of a mother with pulmonary tuberculosis in the contagious phase, untreated or with less than three weeks on antitubercular drugs at delivery, should be separated from the mother but fed with expressed human milk, as transmission often occurs via the airways. The mother's sputum should be submitted to the acid-fast smear test, and she should only be allowed to be in contact with her infant after the test yields negative results.<sup>10</sup> The infant should receive chemoprophylaxis with isoniazid, at the dose of 10 mg/kg/day for three months and then be submitted to the tuberculin skin test. If the test result is positive, the disease should be traced by clinical and radiological examination. If no active infection is detected, surveillance and chemoprophylaxis should be maintained up to the sixth month, when intradermal BCG is applied. If the tuberculin test is negative at three months of life, chemoprophylaxis may be interrupted and intradermal BCG applied, and clinical surveillance should be maintained. Situations in which there may be risks of not following up the infant on isoniazid therapy, concomitant intradermal BCG vaccination is recommended.<sup>7,17</sup>

According to the WHO, breastfeeding should be maintained, but the close contact between mother and infant should be reduced, and the following precautions should be taken: a mask or similar device should be worn while breastfeeding, hands should be carefully washed, and those infected with the disease, especially household members, should be identified. The infant should be treated with hydrazide (INH) at the dose of 10 mg/kg, once a day for six months. After chemoprophylaxis is over, the infant should receive intradermal BCG. Breastfeeding should not be discontinued in any of these phases.<sup>9,37</sup>

There are no restrictions on breastfeeding for mothers who are in the non-contagious phase of tuberculosis, whose

treatment began more than three weeks ago, and in this case, the baby should be vaccinated with intradermal BCG at birth. In cases in which the diagnosis of maternal tuberculosis was established after the onset of breastfeeding, the infant should be regarded as potentially infected and should receive chemoprophylaxis.

Breastfeeding should not be discontinued because the administration of antitubercular drugs in the mother is not a contraindication for breastfeeding.

Table 2 shows the WHO recommendations for tuberculosis cases and the management of breastfeeding, considering the possibility of not using the tuberculin skin test.

It is paramount to underscore that all infants should be monitored as to their weight gain and health status. Special attention should be given to infants whose mothers have risk factors for multidrug-resistant tuberculosis. In this case, the separation of mother and infant may be necessary, as the mother, under this circumstance, shows increased infectiousness and takes longer to respond to therapy. Breastfeeding may be maintained provided that expressed milk is used, thus reducing the respiratory contact between mother and infant.<sup>17</sup>

#### **Hansen's disease**

Hansen's disease is a chronic infectious disease with high infectiousness and low pathogenicity. Its clinical course varies, basically depending on the individual's cellular immune response. The disease is transmitted by

person-to-person contact, especially long contact, by means of nasal and cutaneous secretions. The bacillus can be isolated in breastmilk in cases of untreated Hansen's disease, as well as in patients treated during less than three months with sulfone (dapson or clofazimine) or less than three weeks with rifampicin. Skin lesions on the breast can be a source of infection for the infant.

There is no contraindication for breastfeeding if the mother is receiving proper treatment.<sup>10</sup> The infant should be treated as early as possible, simultaneously with the mother. The drugs used are the same ones used in the mother and may cross into human milk at low concentrations, but there is no report of severe side effects. The infant should be followed up and submitted to regular clinical exams for early detection of possible signs of the disease. Moreover, the following is recommended before and during breastfeeding: careful handwashing, wearing of a mask while handling the infant and covering of breast lesions.

The contagious mother (untreated or treated for less than three months with sulfone or three weeks with rifampicin) should avoid contact with her baby, except to breastfeed; she should wear a mask or similar device, wash her hands carefully before handling the infant and disinfect nasal secretions and baby wipes.<sup>10</sup>

#### **Syphilis**

Syphilis is a disease that is basically sexually transmitted; however, other modes of transmission exist, such as contact

**Table 2 -** WHO recommendations for tuberculosis cases and the management of breastfeeding according to the time at which diagnosis was made

Active maternal tuberculosis diagnosed before the delivery			Active maternal tuberculosis diagnosed after the delivery	
> 2 months before		< 2 months before	< 2 months after	> 2 months after
Negative sputum before the delivery	Positive sputum before the delivery	-	-	-
To treat the mother	To treat the mother	To treat the mother	To treat the mother	To treat the mother
To breastfeed	To breastfeed	To breastfeed	To breastfeed	To breastfeed
There is no need of chemoprophylaxis	Isoniazide for the infant for 6 months	Isoniazide for the infant for 6 months	Isoniazide for the infant for 6 months	Isoniazide for the infant for 6 months
BCG at birth	BCG after the end of chemoprophylaxis	BCG after the end of chemoprophylaxis	BCG after the end of chemoprophylaxis	If BCG was not given at birth, the infant should receive after the end of chemoprophylaxis

Source: adapted from Giugliani ERJ<sup>9</sup> and WHO<sup>37</sup>.

with people with active lesions in mucous membranes, genital region and breasts. There is no evidence of transmission via human milk, without breast lesions. A nursing mother with primary or secondary syphilis with breast involvement can infect the infant through the contact of lesions with the mucous membranes. If there are lesions on the breasts, especially on the areola, breastfeeding or use of expressed milk is contraindicated until full treatment and regression of lesions. Twenty-four hours after penicillin therapy, the infectious agent (spirochete) is seldom detected in the lesions. Thus, there is no contraindication for breastfeeding after proper treatment.<sup>10,38</sup>

### **Brucellosis**

Detection of *Brucella melitensis* in human milk has been reported, and so have cases of brucellosis in exclusively breastfed infants. This confirms the possibility of brucellosis being transmitted via breastmilk.

In the acute phase of severe disease in the mother, breastfeeding should be avoided, but the use of expressed and pasteurized human milk is allowed. Breastfeeding may be restored as soon as the disease is treated with antimicrobials and the nursing mother shows clinical improvement.<sup>39,40</sup>

### **Parasitic infections**

#### **Malaria**

Since malaria is not transmitted among humans, breastfeeding may be maintained if the mother's clinical conditions allow so. There is no evidence indicating that malaria can be transmitted via breastfeeding.<sup>38</sup> For mothers who need to be treated, chloroquine, quinine and tetracycline are recommended. Sulfonamides should be avoided in the first month of breastfeeding.<sup>18</sup> Therefore, a nursing mother with malaria may breastfeed during the treatment with specific drugs.

#### **Chagas' disease**

Studies show that *Trypanosoma cruzi* can be isolated in human milk in acute and chronic forms of Chagas' disease. There was a case report of acute infection in a two-month-old infant breastfed by an infected mother.<sup>41</sup> Although late sequelae may develop, acute disease in the infant tends to be benign. This, combined with the remote possibility of transmission of the disease, is reason enough for maintaining breastfeeding in women with the chronic form of the disease, except if the nipples bleed and have fissures.<sup>42</sup> In cases of acute disease, breastfeeding should be contraindicated.<sup>41,42</sup>

Lab experiments using samples of human milk contaminated with the protozoan and tested under different conditions demonstrate that milk pasteurization prevents the transmission of the disease. Rats orally and intraperitoneally inoculated with human milk containing the parasite were infected; however, the control group with animals inoculated with pasteurized milk was not

infected.<sup>43,44</sup> Animal experiments using human milk heated to 63 °C in a household microwave oven (7 minutes, 45% power) proved efficient in reducing the transmission of *Trypanosoma cruzi*.<sup>45</sup>

### **Fungal infections**

#### **Paracoccidioidomycosis**

Systemic granulomatous disease caused by a fungus, whose transmission occurs via respiratory secretions. There is no contraindication for breastfeeding. However, it should not be forgotten that cotrimoxazole, commonly used for the treatment of paracoccidioidomycosis, is excreted into breastmilk and may produce severe side effects in the infant.<sup>38,40</sup>

#### **Cryptococcosis**

Fungal disease with worldwide distribution. Immunocompromised patients, including those with HIV/AIDS, are at greater risk for cryptococcosis. The transmission of particles in the environment occurs via aerosol droplets, and no documentation exists of person-to-person transmission. Therefore, breastfeeding is not contraindicated.<sup>38,40</sup>

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