Imported food risk advice

Group B *Streptococcus* in human milk and human milk products

Context of this risk advice

- Human milk means expressed milk collected from lactating women to be fed to infants that are not the biological infants of the women supplying the milk.
- Human milk products means products derived from human milk that have been specially formulated to meet the specific nutritional needs of infants such as fortifiers and formula.
- The level of risk for this hazard in human milk and human milk products was determined assuming that the most vulnerable category of infants (preterm infants in hospital neonatal intensive care units) would be receiving the products.

Nature of the hazard

Group B *Streptococcus* (GBS), specifically *Streptococcus agalactiae* is a Gram-positive, non-spore forming round bacterium that can grow in aerobic and anaerobic conditions. GBS can colonise and grow in the milk ducts of the human breast resulting in high concentrations of the bacteria in the milk. GBS is sensitive to pasteurisation temperatures. Asymptomatic infection in adults is common (Hansen et al. 2004), however GBS infections in infants can lead to life threatening illnesses and chronic sequelae.

Transmission

Two types of GBS disease are known to occur in infants: early onset, which occurs from birth through to day 6 of life, and late onset, which occurs from day 7 through to day 89. Early onset disease is vertically transmitted to the baby from the mother colonised with GBS during vaginal childbirth. Late onset GBS can be transmitted from mothers, with or without mastitis, to infants via contaminated breast milk (Filleron et al. 2014). In preterm, low birth weight infants, Olver et al. (2000) report on a case of triplets delivered at 26 weeks gestation by caesarean section, seven days after membrane rupture, who developed late onset GBS. Two high vaginal swabs taken from the mother before delivery were negative for GBS. One of the triplets developed illness associated with GBS infection on day 12 and GBS was isolated from blood cultures; the second and third infants succumbed to GBS infection on day 33 and 35, followed by recurrent infection of the first infant on day 63. A sample of expressed breast milk on day 68 yielded a pure culture of GBS at a concentration of $>10^5$ cfu/ml; a repeat sample of expressed milk yielded a pure culture at similar concentration. Olver et al. (2000) concluded that transmission of GBS to the triplets was via their mother's milk.

The prevalence of GBS in breast milk is variable. A study of Swedish donor mothers by Kvist et al. (2008) reported the presence of GBS in the breast milk from 10% of healthy breast milk donors (n=466) and 21% of women with mastitis (n=192). Microbiological testing of pooled samples from individual donors from an Australian milk bank found a very low prevalence of *S. agalactiae* of 0.14% (n=2890) (Almutawif et al. 2017).

Disease severity

GBS is a severe hazard as it causes potentially life-threatening illness with chronic sequelae. Late onset GBS infections can lead to neonatal sepsis, pneumonia and meningitis (Berardi et al. 2013; Burianova et al. 2013; Dinger et al. 2002). Osteomyelitis[1] and arthritis may occur but are relatively rare. Recovery from GBS illness without long term sequelae can occur following antibiotic therapy (Kotiw et al. 2003). However, long term neurological damage has been reported in 25% to 50% of survivors of meningitis (Dinger et al. 2002; Edwards and Baker 2010). Deaths

[1] Infection of the bone

due to late onset neonatal infection have been reported with a case fatality ratio between 3% and 5% for late onset infection (Kotiw et al. 2003).

Infectivity

The infective dose of GBS in human milk is unknown. The concentration of GBS in human milk reported in investigations of clinical neonatal cases varies between 10^3 CFU/ml to $>10^9$ CFU/ml. Clinical reports of meningitis and septicaemia due to GBS linked to breast milk reported counts of $>10^6$ CFU/ml (Dinger et al. 2002; Filleron et al. 2014). This suggests GBS has a low or very low infectivity, with large quantities ($>10^3$ CFU) likely needed to cause infection.

Risk mitigation

Controls are required to minimise contamination of human milk with GBS. Experimental studies using Holder pasteurisation (62.5°C, 30 min) have been shown to kill GBS in human milk (Jones et al. 1979; Wills et al. 1982). International human milk banks, including those in Australia, routinely perform Holder pasteurisation on human milk to ensure the microbiological safety of donor human milk (Bharadva et al. 2014; Hartmann et al. 2007; HMBANA 2015; UKAMB 2003).

Evaluation of uncertainty

There is uncertainty around the infectivity of GBS and the high concentrations found in human milk. Burianova et al. (2013) and Kotiw et al. (2003) have postulated an exposure pathway for late onset GBS starting with the infection of infants from perinatal sources followed by colonisation of mammary ducts resulting in high concentrations in the breast milk, and the subsequent chronic exposure of the infant to high concentrations of GBS. Evidence of GBS for pre-pasteurisation breast milk from milk banks testing suggests a low prevalence of positive samples (due to existing risk mitigation strategies).

Pooling of human milk from multiple donors is common practice amongst many human milk banks and would dilute the bacterial load from a single donor, however some milk banks only pool milk from individual donors (Haiden and Ziegler 2016). The Australian Red Cross milk bank pasteurises human milk in single donor batches (Australian Red Cross 2018).

Risk characterisation

Late onset GBS is a severe hazard as it causes potentially life-threatening illness with chronic sequelae. There is uncertainty regarding the infectivity of GBS in human milk, however the available evidence indicates that large doses may be required to cause illness, corresponding to low or very low infectivity. There is a medium likelihood of exposure to GBS through human milk as there is evidence of GBS being present in human milk at very high concentrations of $>10^6$ CFU/ml in the absence of mastitis and some evidence linking consumption of human milk to the development of late-onset illness.

In imported human milk and human milk products, GBS presents a potential medium risk to public health and safety.

This risk advice was compiled in: March 2019, updated October 2019

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