Human breast milk is considered to be the most important nutrient for newborn babies, especially preterm ones. If the mother does not produce sufficient milk, fresh frozen unpasteurised milk from a milk bank should be available to all ill neonates until the mother’s own production is established.

Very low birthweight (VLBW) infants and those with a gestational age of less than 32 weeks are considered to be immunocompromised with a risk of developing serious infections. Bank milk should therefore be free of pathogenic bacteria and generally have a bacterial content of less than $10^4$ colony forming units/ml. The donors should test negative for cytomegalovirus (CMV), HIV, and hepatitis B and C, in order to prevent a serious viral infection.

Early use of breast milk for preterm infants has resulted in a reduced incidence of necrotising enterocolitis, faster tolerance of enteral feeding, and a reduced need for parenteral nutrition. It is important to have milk from a CMV-IgG negative donor to VLBW infants considered immunocompromised.

Methods: Between January 1st and December 31st 2001, 69 women delivered 1,973 litres (mean 28.6 litres/woman/year). 73% had college education, were primipara, and with a mean age of 30.7 years. Those who smoked, used alcohol or any medications were refused as donors. They started to deliver approximately 7 weeks after having given birth and continued for a mean of 4 months. Each milk sample was tested for bacterial growth. Every donor was screened for HIV, CMV-IgG and hepatitis B/C before donating milk and thereafter every third month.

Results: 62.3% was CMV-IgG positive. Samples containing Staphylococcus aureus, Klebsiella-, Enterobacter- and Serratia-species or E. coli, and all samples containing $>10^4$ cfu/ml were pasteurised. Overall, only 10.5% of the samples were pasteurised.

Conclusion: It is possible and important to provide VLBW babies with fresh frozen unpasteurised CMV-IgG negative breast milk until their own mothers’ milk production is sufficient.

RESULTS

The women started to donate milk about seven weeks (median) after having given birth (range 1–21 weeks) and continued for a mean of four months (range 1–13). During the study period, the women delivered a total of 1,973 litres breast milk (mean 28.6 litres/woman/year). The total amount of milk donated was 2,673 litres, with a mean amount of 38.7 litres/woman. The highest amount from one woman was 392 litres. Two thirds of the mothers were CMV IgG positive (62%). None tested positive for HIV or hepatitis B or C.

Samples containing Staphylococcus aureus, Klebsiella-, Enterobacter-, Serratia-species, or Escherichia coli were not accepted as “fresh frozen” and were thus pasteurised. All samples with a bacterial count of more than $10^4$ colony forming units/ml were pasteurised (56°C for 30 minutes). All the pasteurised samples were retested for bacterial growth and only accepted when germ-free.

CORE MESSAGE

It is possible and important to provide VLBW babies with fresh frozen unpasteurised CMV-IgG negative breast milk until their own mothers’ milk production is sufficient.

Objective: Breast milk is the most important nutrient to all newborn babies. If the mother’s milk production is insufficient, it is important to provide donor breast milk without reduction of its immunologic and antimicrobial properties. Early use of breast milk to preterm infants has shown a reduced incidence of necrotising enterocolitis, a faster tolerance of enteral feeding, and a reduced need of parenteral nutrition. It is important to have milk from a CMV-IgG negative donor to VLBW infants considered immunocompromised.

Methods: Between January 1st and December 31st 2001, 69 women delivered 1,973 litres (mean 28.6 litres/woman/year). 73% had college education, were primipara, and with a mean age of 30.7 years. Those who smoked, used alcohol or any medications were refused as donors. They started to deliver approximately 7 weeks after having given birth and continued for a mean of 4 months. Each milk sample was tested for bacterial growth. Every donor was screened for HIV, CMV-IgG and hepatitis B/C before donating milk and thereafter every third month.

Results: 62.3% was CMV-IgG positive. Samples containing Staphylococcus aureus, Klebsiella-, Enterobacter- and Serratia-species or E. coli, and all samples containing $>10^4$ cfu/ml were pasteurised. Overall, only 10.5% of the samples were pasteurised.

Conclusion: It is possible and important to provide VLBW babies with fresh frozen unpasteurised CMV-IgG negative breast milk until their own mothers’ milk production is sufficient.
Banked breast milk

Table 1 Relevant details of 69 women who donated breast milk during the one year study period

<table>
<thead>
<tr>
<th>Mean (SD)</th>
<th>Median (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.8 (4.9)</td>
</tr>
<tr>
<td>Number of pregnancies</td>
<td>1.74 (0.98)</td>
</tr>
<tr>
<td>When started to donate milk (weeks)</td>
<td>7.35 (4.4)</td>
</tr>
<tr>
<td>How long did they donate milk (months)</td>
<td>3.87 (2.96)</td>
</tr>
<tr>
<td>Amount of milk donated (litre)</td>
<td>28.7 (61.3)</td>
</tr>
<tr>
<td>College/university</td>
<td>72.5%</td>
</tr>
<tr>
<td>High school (12 years)</td>
<td>15.9%</td>
</tr>
<tr>
<td>Compulsory nine year schooling</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

In some samples, two or more bacteria were detected. The types presented in italics were pasteurised regardless of number of colony forming units.

DISCUSSION

Human breast milk is considered to be the most important nutrient for newborn babies especially VLBW ones. Owing to its anti-infectious effect and immunoglobulin content, breast milk is preferable to preterm milk formulas.1–6 If a mother has her own milk production is established.

VLBW infants are considered to be immune incompetent, with an increased risk of developing serious infections.7–10 The use of intravenous IgG has, however, been debated.16 17 The content of immunoglobulins (IgA) in breast milk is therefore of great importance for the protection of the immunocompromised VLBW infants.8

Bank milk should therefore contain no bacteria that may cause infection or ≥ 10^4 colony forming units/ml of any bacteria.18 Milk from a bank milk should also be free of infectious viruses, such as CMV, hepatitis B/C, and HIV. The donor should have a negative serum screen for these viruses before starting to donate milk.

Necrotising enterocolitis is a serious disease that can affect the VLBW infant. It has been shown that breast milk protects against the development of this disease,9–13 supporting the importance of the early introduction of breast milk to preterm infants.9–13

Even though the fetus swallows amniotic fluid, the intestine is not prepared for enteral feeding. It has, however, been shown that early enteral feeding, even small amounts (trophic feeding), improves gut motility and thereby the tolerance of enteral feeding in the VLBW infant.14

Early tolerance of enteral feeds means that the need for parenteral nutrition is reduced. As parenteral feeding is associated with, among other things, increased risk of infections, liver impairment, and thrombocytopenia,14 15 early introduction of breast milk will thus reduce these complications.

To be able to provide fresh frozen human breast milk to every VLBW infant, it is important to maintain a milk bank and thus the possibility to provide the optimum substitute for mother’s own milk.

It has been debated whether fresh frozen milk donated to a milk bank from a CMV IgG negative mother is superior to the milk from the infant’s own mother, not knowing or before knowing her CMV status.20 21 Should a CMV positive mother be allowed to breast feed her own child? Or should her milk be kept frozen for three or more days or even pasteurised? It is important to look out for signs of CMV infection in VLBW infants fed their own mother’s milk without knowing her CMV status. If any of our infants develop severe pulmonary problems, a sample of their urine is tested for CMV. If the test is positive, the infection is more likely to come from its mother than from the banked milk.

The use of fresh frozen unpasteurised bank milk promotes enteric feeding of live microbial supplements (probiotics) which may provide benefit and help to prevent diseases such as necrotising enterocolitis.22

This study shows that our milk bank is run safely to provide fresh frozen unpasteurised, CMV negative donor breast milk to every VLBW neonate (< 1500 g), providing optimal growth and development of the infant.

Authors’ affiliations

P C Lindemann, R Lindemann, Neonatal Intensive Care Unit, Department of Paediatrics, Ullevål University Hospital, NO-0407 Oslo, Norway
I Foshaugen, R Lindemann, The Milk Bank, Ullevål University Hospital

REFERENCES


Table 2 Type of bacteria and occurrence in milk samples

<table>
<thead>
<tr>
<th>Type of bacterium</th>
<th>Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus epidermidis</td>
<td>85.0</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>13.1</td>
</tr>
<tr>
<td>α Haemolytic streptococcus</td>
<td>10.6</td>
</tr>
<tr>
<td>Acinetobacter species</td>
<td>5.4</td>
</tr>
<tr>
<td>Serratia species</td>
<td>2.5</td>
</tr>
<tr>
<td>Klebsiella species</td>
<td>2.0</td>
</tr>
<tr>
<td>Enterobacter species</td>
<td>1.8</td>
</tr>
<tr>
<td>Bacillus species</td>
<td>1.5</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>0.45</td>
</tr>
<tr>
<td>Others</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The use of fresh frozen unpasteurised bank milk promotes enteric feeding of live microbial supplements (probiotics) which may provide benefit and help to prevent diseases such as necrotising enterocolitis.22

This study shows that our milk bank is run safely to provide fresh frozen unpasteurised, CMV negative donor breast milk to every VLBW neonate (< 1500 g), providing optimal growth and development of the infant.