

BREASTFEEDING ANSWERS

Made Simple

A Guide for Helping Mothers

Nancy Mohrbacher, IBCLC, FILCA

co-author of *The Breastfeeding Answer Book* & *Breastfeeding Made Simple*

Breastfeeding Answers Made Simple

A Guide for Helping Mothers

Nancy Mohrbacher, IBCLC, FILCA

© Copyright 2010 by Nancy Mohrbacher

Hale Publishing, L.P.

1712 N. Forest St.

Amarillo, TX 79106-7017

806-376-9900

800-378-1317

www.iBreastfeeding.com

www.hale-publishing.com

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, stored in a database or any information storage, or put into a computer, without prior written permission from the publisher.

Library of Congress Control Number: 2010926441

ISBN-13: 978-0-9845039-0-2

MILK STORAGE AND HANDLING

Milk Storage Guidelines

For Full-Term, Healthy Babies

The live cells in freshly expressed human milk kill bacteria, keeping milk fresh longer. Two Spanish studies found that when freshly expressed human milk is refrigerated its bacteria-killing properties stay active for the first few days, but begin to decline after 72 hours (Martinez-Costa et al., 2007; Silvestre, Lopez, March, Plaza, & Martinez-Costa, 2006).

.....

One U.S. study found no statistically significant differences between the bacterial levels of milk stored for 10 hours at room temperature and milk refrigerated for 10 hours, when a temperature range of 66°F to 72°F (19°C to 22°C) was maintained (Barger & Bull, 1987). But “room temperature” varies greatly by season and geography. While the temperature range used in this study is common in Chicago’s temperate climate where this study took place, it is rare in tropical climates. Another U.S. study found that storing expressed milk at a slightly warmer temperature—77°F (25°C)—shortened safe storage time to 4 hours (Hamosh, Ellis, Pollock, Henderson, & Hamosh, 1996).

Research done in Nigeria’s tropical climate found that colostrum—which inhibits bacteria growth more effectively than mature milk—could be safely stored at 81°F to 90°F (27°C to 32°C) for up to 12 hours (Nwankwo, Ofor, Okolo, & Omene, 1988).

.....

One U.S. study, which attempted to more closely replicate the conditions mothers face daily, found that milk stored at slightly below room temperature (60° F/15° C) stayed fresh for up to 24 hours (Hamosh et al., 1996).

.....

Suggest the mother store her milk in the back of the refrigerator and away from the door, where there is greater temperature fluctuation. Early research on refrigerated milk limited its study period to 24 hours (Pittard, Anderson, Cerutti, & Boxerbaum, 1985). Later research that extended the study period to 5 days found that bacterial counts continued to be low this entire time (Sosa & Barnes, 1987). A Belgian study found that after 8 days of refrigeration some batches of milk actually had bacterial levels lower than when the milk was first expressed (Pardou, Serruys, Mascart-Lemone, Dramaix, & Vis, 1994). These researchers concluded that milk used within 8 days should be refrigerated, rather than frozen, because the antimicrobial qualities of human milk are better preserved by refrigeration.

If bacterial count (one gauge of milk spoilage) is the only factor considered, the 8-day guideline for refrigerated milk makes sense. But when milk is refrigerated

Human milk takes longer to spoil than pasteurized cow’s milk because its live cells kill bacteria.

Storage guidelines for milk kept at room temperature vary by temperature.

Fresh milk can be safely stored in an insulated cooler bag with frozen ice packs for at least 24 hours.

Storage guidelines for milk kept in a refrigerator vary by criteria and the baby’s health.

longer than 72 hours, other changes occur, such as a decrease in vitamin C levels and antioxidant properties (Buss, McGill, Darlow, & Winterbourn, 2001; Hanna et al., 2004). For this reason, some recommend mothers use refrigerated milk within a shorter time, such as 72 hours or 5 days (ABM, 2009; Meek, 2002). If a baby is ill or preterm, shorter guidelines may also be used (see later section "For the Hospitalized Baby").

Although it is always better to use expressed milk sooner rather than later, if a mother of a young baby finds an 8-day-old container of expressed milk in the back of her refrigerator, she should consider her situation. If she has more expressed milk available, she may decide to discard the older milk. But if her only other option is to give infant formula, using the stored milk would be the better choice. When in doubt, suggest the mother smell her milk. Spoiled milk usually smells sour.

.....

Storage guidelines for frozen milk vary based on type of freezer.

Milk storage guidelines for frozen milk are based on the temperature fluctuation expected in each freezer type:

- Freezer compartment located inside a refrigerator—2 weeks
- Separate-door refrigerator/freezer—3 to 4 months
- Deep freeze—6 to 12 months

Suggest the mother store her milk in the back of the freezer away from the door and fluctuating temperatures. If stored in a refrigerator/freezer, suggest the mother put her milk on a rack or shelf above the freezer floor to avoid warming during the automatic defrost cycle (Walker, 2006). Before freezing, suggest the mother fill the container no more than about three-quarters full to allow for the normal expansion of the milk during freezing and to tighten bottle caps after the milk is completely frozen to allow displaced air to escape (Jones & Tully, 2006). For more details, see Table 11.4.

.....

Before freezing too much milk, suggest the mother thaw some frozen milk to see if it smells soapy or rancid.

When a mother's cooled or frozen milk develops a soapy smell, this is probably due to high levels of lipase, the enzyme that breaks down fat. Depending on her milk lipase level, some mothers notice this change in smell and/or taste after a short time in the freezer, or later after the milk has been frozen longer. Freezing slows but does not stop the lipase from digesting the fat in the milk (Berkow et al., 1984; Bitman, Wood, Mehta, Hamosh, & Hamosh, 1983).

This milk is considered safe for the baby, and in most cases, the baby will accept it (Lawrence & Lawrence, 2005). But if the baby refuses the milk, the mother can prevent this change in smell and/or taste from occurring by scalding her milk before storing it, which will deactivate the lipase. This is done by heating the milk in a pan on the stove until it is bubbling around the edges, but not yet boiling, and then cooling the milk quickly (Jones & Tully, 2006). Although heating milk is not routinely recommended, if the baby will not accept expressed milk otherwise, this may be the only way the mother's milk can be used.

To avoid having to discard large amounts of frozen milk, suggest any mother planning to freeze her milk first freeze several test batches, thaw them after about a week, and smell the milk to see if its smell or taste has changed. If it has, suggest she check to see if her baby will take it. If the baby accepts it, the mother

doesn't need to do anything else. If the baby rejects it, suggest she scald future batches before freezing.

Sour or rancid-smelling milk is probably unrelated to milk lipase levels. According to some milk storage experts, the most likely cause is chemical oxidation, rather than lipase-caused digestion of milk fat or bacterial contamination (Jones & Tully, 2006). Possible contributing factors are the mother's intake of polyunsaturated fats or free copper or iron ions in her water. In this case, heating the milk can actually speed oxidation, making the problem worse. While she is storing milk for her baby, suggest any mother whose expressed milk smells rancid or sour temporarily avoid her usual drinking water and any fish-oil or flaxseed supplements, as well as any foods like anchovies that contain rancid fats. While handling her milk, suggest she also avoid exposing it to her local water. It may also help to increase her antioxidant intake by taking beta carotene and vitamin E.

Table 11.4. Mature Milk Storage Times for Full-Term Healthy Babies at Home

Milk Storage/ Handling	Deep Freeze (0°F/ -18°C)	Refrigerator/ Freezer (variable 0°F/-18°C)	Refrigerator (39°F/4°C)	Insulated Cooler with Ice Packs (59°F/15°C)	Room Temperature	
					(66°F-72°F/19°C- 22°C)	(73°F-77°F/23°C- 25°C)
Fresh	Ideal: 6 mos. Okay: 12 mos.	3-4 Months	Ideal: 72 Hours Okay: 8 days	24 Hours	6-10 Hours	4 Hours
Frozen, Thawed in Fridge	Do Not Refreeze	Do Not Refreeze	24 Hours	Do Not Store	4 Hours	4 Hours
Thawed, Warmed, Not Fed	Do Not Refreeze	Do Not Refreeze	4 Hours	Do Not Store	Until Feeding Ends	Until Feeding Ends
Warmed, Fed	Discard	Discard	Discard	Discard	Until Feeding Ends	Until Feeding Ends

(Jones & Tully, 2006; LLLI, 2008)

.....

Milk that collects in breast shells tends to be lower in fat than actively expressed milk (Lucas, Gibbs, & Baum, 1978). It has also been found to contain higher levels of common skin bacteria (Gessler, Bischoff, Wiegand, Essers, & Bossart, 2004), probably due to prolonged skin contact. For these reasons, current guidelines recommend mothers discard this "drip milk" rather than storing it or feeding it to their babies (Jones & Tully, 2006).

.....

Milk that collects in breast shells, or "drip milk," should be discarded.

The safety of refreezing thawed milk is most likely only going to be a major issue during a power outage for the mother with a large stash of frozen milk. One U.S. study researched the effects of refreezing milk using donor milk expressed by mothers who used no special sanitary precautions (Rechtman, Lee, & Berg, 2006). The frozen milk was thawed at refrigerator temperature (39° F /4° C) overnight, separated into different sample batches, and refrozen to -80°C (-110°F). These sample batches were later thawed to room temperature (73°F/23°C) and each batch exposed to one of the following conditions: 46°F (8°C) for 8 or 24 hours,

Current guidelines recommend against refreezing thawed human milk.

Current guidelines recommend against saving any milk left in the container after a feeding.

Don't save milk left in a container after feeding.

Each batch of milk should be labeled with the date, and in some cases, the baby's name and the time it was expressed.

To avoid waste, store milk in amounts no larger than the baby might take at a feeding.

On average, breastfed babies take much less milk per day than babies fed formula.

73°F (23°C) for 4 or 8 hours, multiple freeze-thaw cycles of varying lengths, and the control batch kept at a steady -4°F (-20°C). None of the batches developed unacceptable bacterial counts and vitamin content remained at adequate levels. As of this writing, guidelines to not refreeze milk have not yet been changed to reflect this research.

Mothers are often told to discard any milk left after a feeding because the milk mixes with the baby's saliva. Although no published studies have examined the safety of keeping leftover milk, a college student researched this scenario for her unpublished senior thesis (Brusseau, 1998). In her study, she divided fresh milk donated from six women into two bottles, one of which was warmed and partially fed to their babies. The leftover milk and the milk in the bottle not fed (the control milk) were cultured immediately after feeding and 12, 24, 36, and 48 hours later. The only milk with increased total bacterial counts was one batch of the warmed and fed milk from a mother who had not followed instructions and had donated previously frozen instead of fresh milk. All other batches of milk showed no change in total bacterial counts within 48 hours after feeding.

Including the day, month, and year on the milk-storage container will allow the milk to be used in the order it was expressed. If the milk will be given in a group setting, such as a hospital or day-care facility, the baby's name should also be written on each container. If the mother is expressing milk for her preterm baby or to donate to a milk bank, she may also be asked to label it with the time of day it was expressed.

For the baby older than about 1 month, suggest the mother start by freezing her milk in 2- to 4-ounce (60-118 mL) quantities, which is about how much babies on average take from the breast (Kent et al., 2006). Small amounts thaw and warm faster, and less milk will be discarded if the baby does not take it all. If the baby wants more milk, it can always be added. Before she learns how much milk is right for her baby, suggest she store some smaller 1- to 2-ounce (30-59 mL) amounts to provide a little extra if needed.

Although there is a large range of normal milk intakes among breastfeeding babies (Kent et al., 2006), the baby receiving only mother's milk usually takes less milk per day than the baby receiving formula. One U.S. study found that at 4 months of age breastfeeding babies consumed on average 25% fewer calories than formula-fed babies of the same age, even though their weight gains were comparable (Butte, Garza, Smith, & Nichols, 1984). Another U.S. study found that at 6 months breastfed babies, on average, consume 23% less milk than their formula-feeding counterparts (Heinig, Nommsen, Peerson, Lonnerdal, & Dewey, 1993). This could be important information for the mother who is gauging her baby's milk needs on her neighbor's formula-fed baby. (For more details on the reasons for this difference, see p. 207- "Growth from Birth to 12 Months.")

When batches of expressed milk are combined, the milk should be dated according to the oldest milk. For example, if refrigerated milk from May 10 is combined with milk expressed on May 11, the combined batch should be dated May 10. Although some groups recommend restricting batches to milk expressed the same day (ABM, 2009), at this writing there is no evidence to support this restriction.

Fresh milk can be added directly to refrigerated milk without cooling it first. Fresh milk can be added to frozen milk, as long as there is less fresh milk than frozen milk, and it is first cooled for about an hour, so it does not thaw the top layer.

A Brazilian study found low levels of live yeast in human milk that was previously frozen and thawed (Rosa, Novak, de Almeida, Medonca-Hagler, & Hagler, 1990) and concluded that freezing milk may not kill yeast. However, the researchers acknowledge the possibility that the milk became contaminated with live yeast during its handling. There is currently no evidence to indicate that milk expressed and stored during a nipple infection or thrush in baby's mouth can cause a recurrence. If the mother is concerned, an alternative to discarding stored milk is to boil it before feeding, as boiling kills yeast.

For Hospitalized Babies

Any mother of a preterm or sick baby needs to ask about milk-storage protocols at her hospital. In some institutions, sterile storage containers are provided and special labeling processes followed (Hurst & Meier, 2010). The hospital may also specify how much milk to put in each container and provide storage times for refrigerated and frozen milk that differ from those for home use. For sick or preterm babies, the Human Milk Banking Association of North America recommends expressed milk be refrigerated immediately, rather than allowing it to stay at room temperature. Milk storage guidelines will also differ if fortifier is added to the mother's milk (Jones & Tully, 2006). Human milk is not sterile, and bacteriologic screening is not usually recommended because there are currently no generally agreed upon acceptable levels of bacteria in the milk (Jones & Tully, 2006; Law, Urias, Lertzman, Robson, & Romance, 1989).

Preterm and sick babies are at higher risk for serious and even life-threatening health problems, so stricter hygiene precautions are needed. Simple steps like hand-washing before expressing milk can be critical in preventing contamination of the milk (Novak, Da Silva, Hagler, & Figueiredo, 2000). For more details, see p. 355- "Milk Handling and Safety."

Stricter hygiene precautions are needed when storing milk for ill or preterm babies.

In previous years, breast-washing and discarding the first drops of milk were routinely recommended to mothers of vulnerable babies to try to decrease milk contamination. However, research found no difference in milk contamination when these procedures were followed, so they are no longer recommended (Jones & Tully, 2006).

The mother can combine milk expressed at different times.

It is unknown whether milk stored during a candida infection can cause a recurrence.

Suggest the mother of a hospitalized baby check with the staff for its milk storage guidelines, which vary by institution.

Washing the breast before expressing and discarding the first few drops of milk are no longer recommended.

Before storing milk, any reusable storage container should be washed in hot, soapy water, rinsed well, and air dried.

Expressed milk separates into layers over time and its color may vary.

Suggest the mother thaw frozen milk gently and gradually, keeping heat low.

Before feeding, expressed milk can be warmed to between room and body temperature.

A microwave should not be used to thaw or warm mother's milk.

Handling and Preparing Milk

Washing, rinsing, and drying storage containers, along with good hand-washing by the mother, have been found sufficient to prevent milk contamination (Jones & Tully, 2006; Pittard, Geddes, Brown, Mintz, & Hulsey, 1991). Regular sterilization or sanitization of milk storage containers or pump parts is not currently recommended because no benefits to these extra procedures have been found.

Layers. Because most mothers are familiar with the appearance of homogenized cow's milk, some worry when their expressed milk separates into milk and cream. Reassure the mother this separation is normal in any milk that is not homogenized. Before the milk is fed to the baby, suggest it first be swirled gently to mix the layers.

Colors. Usually human milk appears either bluish, yellowish, or even brownish in color. When a mother consumes some foods, food dyes, and medications, her milk may change color to pink or pink-orange (orange soda or gelatins), green (kelp or green drinks), and even black (minocycline) (Lawrence & Lawrence, 2005). Frozen milk may take on a yellowish color, but it is not spoiled unless it smells or tastes sour.

Freezing and heating human milk destroys some of its immune properties that kill bacteria, making it more vulnerable to contamination. When thawing or warming milk, keep heat low, using one of the following methods:

- Thaw in the refrigerator overnight. Once thawed, milk can be refrigerated for up to 24 hours.
- Hold the container under cool running water for a few minutes.
- Hold the container in water that has been previously heated on the stove. If the water cools and the milk is not yet thawed, remove the container of milk and reheat the water. Do not heat the milk on the stove burner directly.

If using water to thaw or warm the milk, tilt or hold the container, so the water cannot seep under the lid. Thawed milk should not be kept at room temperature. It should be either fed immediately or refrigerated (Jones & Tully, 2006).

Older babies often willingly drink chilled milk directly from the refrigerator (Jones & Tully, 2006; LLLI, 2008). But for a small baby, cold milk may lower body temperature. To warm milk before feeding, hold the container under warm running water or hold it in a pan of water that has been previously heated on the stove.

Two U.S. studies found that heating human milk in a microwave oven destroys much of its anti-infective factors, such as IgA (Quan et al., 1992; Sigman, Burke, Swarner, & Shavlik, 1989). They also found that microwaves heat liquids unevenly, so even if the milk is swirled or shaken afterwards, "hot spots" remain that can burn the baby's throat.

.....

In the U.S., according to the Centers for Disease Control and Prevention, the American Academy of Pediatrics, and the Occupational Safety and Health Administration (OSHA), human milk is not considered a biohazardous material, so rubber gloves are not needed when human milk is handled or fed, nor is a separate refrigerator required (CDC, 1994). At workplaces and at child care facilities, human milk can be stored along with other foods in a common refrigerator and no special precautions are needed.

Storage Containers

Any food-grade container with a tight-fitting, solid lid (rather than one with a nipple/teat) can be used to store expressed milk. If the baby gets most of his nourishment from direct breastfeeding and only occasionally receives expressed milk, the type of storage container is not a major concern. But when a baby receives most of his nourishment from expressed milk, the storage container should be chosen carefully.

Unfortunately, there are few studies on storage containers and their conclusions are conflicting, so current recommendations are based on very limited information. For example, one U.S. study found that more of the milk's leukocytes adhered to glass rather than plastic, which led to the recommendation that fresh milk be stored in plastic (Paxson & Cress, 1979). At that time, glass continued to be recommended for freezing because freezing kills most leukocytes anyway. A second U.S. study found that different types of leukocytes react differently to glass (Pittard & Bill, 1981). A third U.S. study convinced many to recommend glass again when it was found that over time many of the leukocytes were released from the glass, and after 24 hours milk stored in glass had more leukocytes than the milk stored in plastic (Goldblum, Garza, Johnson, Harrist, & Nichols, 1981).

Some recommend glass as a good first choice for freezing milk because it is the least porous, thus providing the best protection.

Some caution against storing milk in polycarbonate plastic containers, which contain the chemical bisphenol-A (BPA), due to concerns that under certain conditions this chemical could leach into the milk, which is associated with potential health risks (LLLI, 2008).

.....

Many mothers find milk storage bags have practical advantages. They take up less storage space than hard-sided containers and can be attached directly to breast pump attachments in place of a bottle. Because they are not reused, there is less to wash.

Types of milk bags. Some types of milk bags are sturdier than others. For example, some bags called "bottle liners" are made primarily for feeding rather than milk storage. These feeding bags tend to be thinner and more prone to splitting. If this type of bag is used to store milk, suggest the mother safeguard her milk by first inserting her bag of milk inside another bag before sealing and storing.

Why home use only? Milk freezer bags are not usually recommended for hospitalized babies because they are not airtight like hard-sided containers, and

Human milk is not a biohazardous substance, so no gloves or other special precautions are needed when handling it.

Glass and plastic containers with solid, tight-fitting lids are recommended for both hospital and home use.

Milk freezer bags can be used to store expressed milk for home use.

Stainless steel storage containers are not recommended because fewer live cells survive.

In some situations, effective milk expression is vital to longer breastfeeding duration.

Some mothers have negative feelings about exclusive milk expression, especially at first.

When mothers are expressing milk for their babies, they may need to grieve normal breastfeeding before they can accept their situation.

there is a greater risk of leaking (Jones & Tully, 2006; Walker, 2006). One U.S. study found a 60% decrease in some antibodies when milk was stored in bags, along with a partial loss of milk fat, which adhered to the sides of the bags (Goldblum et al., 1981). However, only the thin, "bottle liners" were studied, so these findings may not apply to the thicker freezer bags, and these results have not been duplicated. Some recommend milk freezer bags only for milk intended to be stored for less than 72 hours (ABM, 2009).

Sandwich bags. Storing expressed milk in plastic sandwich bags is not recommended because they are thin and tear easily (Jones & Tully, 2006).

Two studies from India compared the survival of live cells in freshly expressed milk when stored in glass or polypropylene plastic storage containers and in stainless steel containers. One study compared glass to stainless steel and found that more live cells survived and fewer stuck to the sides in glass, rather than stainless steel containers (Williamson & Murti, 1996). In the other study, significantly more live cells survived in the polypropylene plastic containers than the stainless steel containers (Manohar, Williamson, & Koppikar, 1997).

MILK EXPRESSION STRATEGIES

When Baby Isn't Breastfeeding

Effective milk expression becomes critical when a baby cannot breastfeed after birth due to illness, prematurity, or other reasons, and expression must take the baby's place in establishing milk production. Effective expression is also vital when a mother needs to maintain her milk production temporarily, such as during a nursing strike and when a mother takes a medication that is incompatible with breastfeeding. This section describes expression strategies that can help mothers in different situations meet their breastfeeding goals.

Establishing Full Milk Production After Birth

Mothers who are unexpectedly faced with milk expression instead of a breastfeeding baby may need to talk about their feelings and make some emotional adjustments. Some of these mothers feel odd or awkward. Some have mentioned feeling "like a cow." If the baby is ill or very preterm, a mother may need to grieve the normal birth and breastfeeding she was expecting before she can accept her situation. One Australian longitudinal study of 17 mothers and fathers of very-low-birthweight preterm babies found that the mothers had very mixed emotions about milk expression, considering it a symbol of both their connection to their baby and their disconnection from their baby while others provided primary care (Sweet, 2008).