THE BREASTFEEDING ANSWER BOOK

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BREAST ANATOMY

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Milk or lactiferous sinuses do not exist

For many years our understanding of the anatomy of the breast was based on intricate dissections of the ductal system in the breast of lactating women after death. Hot colored wax was injected into the duct openings on the nipple surface. The rest of the breast was dissected away and a colored model of the ductal system was left (Cooper 1845).

Much, but not all of what was first demonstrated about breast anatomy is still true today. One significant difference relates to the milk sinuses. In the wax models there were dilated ducts just below the surface of the nipple. This dilated space was thought to be a storage reservoir for milk (Cooper 1845). We now know that the concept of dilated milk ducts, also called lactiferous sinuses, is incorrect (Ramsey 2005 and Geddes 2009). The ducts are distensible and expanded when Cooper injected the wax creating an artificial space or sinus.

Improvements in sonography have revolutionized our understanding of breast anatomy and function. Three-dimensional ultrasound imaging of the breasts of lactating women confirms that there is no dilation of milk ducts below the areola (Gooding 2010). The area just below the areola is filled with glandular tissue just like the rest of the breast (Ramsey 2005, Geddes 2009). The ducts begin to branch very close to the nipple, within 8 mm (0.3 inch) of the areola (Ramsey 2005). Sonography also informs us that more than two thirds of the milk making apparatus can be found within 3 cm (1.2 inches) of the base of the nipple (Ramsey 2005).

A good way to visualize and discuss the breasts glandular tissue is by comparing it to the roots of a tree (Ramsey 2005). The milk is produced in the alveoli at the very tips of the tree roots. The milk is transported via the ductal system to the surface of the breast from the tree roots up to the nipple represented by the tree stump.

There are fewer milk ducts than previously thought

The number of ducts that open at the nipple is another significant change in our understanding of breast anatomy. Using ultrasound it has been determined that the average number of ducts that open on the surface of the breast is between five (Love and Barsky 2004) and nine (Ramsey 2005). This is less than the 15–25 quoted in many texts (Lawrence 2005 and LLLI 2003).

There are many more ducts within the nipple that do not open to the surface. There are several different reasons that could explain why there are more ducts present in the nipple than open on the nipple surface. One explanation is that the ducts branch within the nipple. Another explanation is that some ducts lead to skin appendages such as sebaceous and sweat glands (Goings 2004). Perhaps redundancy was built into a system that was critical for the nourishment and survival of our species.

The fact that not all ducts communicate with the nipple surface was noted by Cooper when he could find 22 ducts, but could only inject 12 from the nipple surface (Cooper 1845). We do not understand why this happens. The fact that there are fewer ducts than previously thought increases the importance of preserving the integrity of each duct. Surgical disruption of even one duct could be significant if a woman has only five especially since the amount of glandular tissue that drains into each duct varies.

Ducts dilate with the milk ejection reflex

Ultrasound has also allowed us to see the ductal distension and the change in the infant’s sucking pattern that occurs with the milk ejection reflex (Ramsey 2004).
Ducts transport milk

The diameter of ducts is between 2–3 mm (0.1 inch) at rest (Ramsey 2004). The duct size increases by 40–70% with the milk ejection reflex and decreases when the milk ejection reflex is over. Milk left in the ducts at that time is transported back deeper into the breast for storage (Ramsey 2004). We currently understand that the ducts transport milk, but do not store it (Ramsey 2005).

The milk line

Extra nipples and breast tissue can occur anywhere along the milk line from the armpit (axilla) to the groin in 2–6% of women (Lawrence 2005). They can look like a freckle, a dimple or a complete nipple. Accessory breast and nipple tissue can lactate (Lawrence 2005). Mothers can be reassured that accessory tissue will not interfere with breastfeeding, although occasionally this tissue may develop mastitis. (Wilson-Clay and Hoover 2008).

Breast shape changes not caused by breastfeeding

Around the world women have fears about breastfeeding causing negative changes in breast shape. In Indonesia this was more common among educated women (Hull 1990). In the Dominican Republic concerns about negative effects on breast shape was the second most common cause for weaning (McClennan 2001).

In a study of 500 Italian mothers at 18 months after delivery of their first baby, 70 percent of the mothers noticed breast changes after pregnancy (Pisacane 2004). Changes included increases or decreases in breast and bra size and sagging breasts. Thirty percent of the mothers described breast enlargement and loss of firmness. Despite maternal concerns, no relationship was found between breastfeeding and changes in breast size, shape or consistency.

In a review of plastic and reconstructive breast surgery patients, 85 percent of women who had been pregnant reported breast changes (Rinker 2010). Approximately 30 percent reported increase and 30 percent reported a decrease in breast size. Breastfeeding was not a risk factor for breast ptosis (drooping or sagging). Risk factors for breast ptosis were older age, larger bra cup size, larger body mass index, significant weight loss not associated with pregnancy, more pregnancies and smoking daily for more than a year.

The data do not support the popular notion that breastfeeding causes negative changes in breasts. Instead it is pregnancy that has been implicated as the cause.

Breast fat and glandular tissue are intermixed

There has been a shift in the thinking about the relationship between adipose (fat) and glandular (milk producing and transporting) tissue in the breast. In the past it was believed the fat and glandular tissue was relatively separate. Most descriptions and depictions of the breast detailed little fat mixed in with the glandular tissue. A prominent exception was Netter who showed fat and glandular tissue in close proximity throughout the breast (Netter 1948 and 2010).

We now know from looking at breast tissue removed during surgery that the glandular tissue is intermingled with the fat tissue throughout the breast (Nickell 2005). Ultrasonography also
allows us to see the fat intermixed between the milk producing parts of the breast (Geddes 2009). The ratio of fat to glandular tissue based on mammography (breast radiographs or 'x-rays') is 1:1 in the non-lactating breast, although larger breast size is associated with a higher amount of fat (Geddes 2007). Lactation is associated with an increase in glandular tissue (Geddes 2009 and Ramsey 2005). The problems some women face with lactation after breast reduction surgery can be better understood when we know that attempts to remove adipose tissue will also result in removal of both milk production and transport tissue (Nickell 2005).

References


Bariatric surgery is increasing

Bariatric surgical procedures have become a popular and very effective way to help morbidly obese people lose weight and avoid associated life-threatening health problems such as heart disease, diabetes and sleep apnea. In 2008 in the United States, more than 220,000 people had this type of surgery and the number is increasing dramatically each year. More than 80% of these surgical procedures are performed on women and currently about half of these women are of childbearing age.

Breastfeeding lowers obesity risk

Children born to obese parents are genetically at risk to become obese themselves. Breastfeeding for at least six months lowers the child’s obesity risk and should be strongly encouraged. To help women successfully breastfeed after bariatric surgery, it is crucial that health care providers clarify the type of surgical procedure that was performed and the date of the surgery as the weight and nutrient losses stabilize 12–18 months after surgery.

Two main types of bariatric procedures

• Restrictive procedures such as the Laparoscopic Adjustable Gastric Band (LAGB) limit the amount of food a person can eat by decreasing the size of the gastric pouch. LAGB is a minimally invasive procedure. A band is placed around a portion of the upper stomach and saline can be easily added to or removed from that band to adjust the amount of constriction and therefore the size of the pouch. Possible decreases in iron and folate absorption may occur due to lower acid content in the pouch. Vitamin B12 must bind to gastric intrinsic factor for absorption. This intrinsic protein is produced by gastric cells and levels are also diminished due to the smaller gastric surface area. These women will require monitoring of iron, B12 and folate levels yearly and more frequently during pregnancy and lactation.

• Malabsorptive procedures, the most common of which is a Roux-en-Y gastric bypass (RYGB), result in a bypass of most of the stomach and part of the small intestines. These procedures affect nutrient absorption more significantly. Lifelong supplementation of micronutrients such as iron, folate, B12, calcium and Vitamin D is required.

Mother’s nutritional requirements

Breastmilk quantity and quality is usually sufficient for infant growth as long as the breastfeeding mother is taking in 1800 calories a day or more and as long as her weight loss has stabilized. Eating enough protein after either type of procedure is important and each of the mother’s meals should be comprised of about 50% protein. After a malabsorptive procedure, the minimum, daily supplementation for nursing mothers should always include:

• Prenatal vitamin daily.
• B12 1000 mcg applied under the tongue daily.
• Iron 65mg in the form of ferrous fumarate daily with 250mg of Vitamin C to maximize absorption.
• And calcium citrate 600 mg twice a day.

However a high percentage of people fail to take supplements as prescribed after bariatric surgery, and postpartum blood loss often requires much higher doses of iron, so the mother’s levels of iron, B12, and Vitamin D should be checked periodically.
Monitor the baby

It is crucial to monitor the baby's weight gain over time as a B12 deficiency or milk production issues can cause lethargy and failure to thrive in the baby. In infancy, Vitamin B12 deficiency can also cause anemia, developmental delays, and permanent neurological problems in addition to failure to thrive. Infants can become symptomatic after even a few months of inadequate vitamin B12 intake. It is also important for a mother to know how to make sure her baby latches on deeply to the breast and is obtaining milk, as the breast tissue is often loose and stretchy after bariatric surgery. Thriving infants need no additional vitamin and mineral supplementation aside from vitamin D, vitamin K and iron as recommended for all breastfeeding infants.

Impact on fertility and contraception

Fertility often improves dramatically in women who have had bariatric surgery and unintended pregnancies may result. However hormonal contraceptives of all kinds should be avoided in this population of lactating women because estrogen and progesterone can decrease milk production and oral medications are unpredictably absorbed. Barrier contraceptive methods are the safest option. Many of these women will continue to have irregular periods as they did before their weight loss and this makes the use of LAM a less reliable method of contraception.

Success

Ninety percent of people will have significant weight loss and dramatic improvements in overall health after bariatric surgery. With careful attention to nutrition and adherence to recommended supplementation dosing, along with close monitoring of infant growth, lower-risk pregnancies and successful breastfeeding experiences are the norm for women in this rapidly growing population.

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CONTRACEPTION

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World Health Organization recommendations

Theoretically hormonal contraceptive use could interfere with breastmilk production, breastfeeding duration, or infant growth. The WHO sums it up best with the statement: “Studies have been inadequately designed to determine whether a risk of either serious or subtle long-term effects exist” (WHO 2010b). Anecdotally a relationship between breastfeeding success and infant growth exists. Many mothers find changes in breastmilk production occur when they use hormonal contraceptives.

First 6 weeks postpartum

The World Health Organization recommends that in the first 6 months postpartum (after birth), breastfeeding mothers “generally” do not use combined hormonal contraceptive methods. After 6 months postpartum combined hormonal contraceptive methods are no longer restricted. This recommendation is based on the belief that combined hormonal contraceptives could have a negative impact on breastmilk production and on infant health in both the short and long term (WHO 2010a).

First 6 weeks postpartum

The World Health Organization recommends that breastfeeding mothers “usually” do not use progestin-only contraceptive methods in the immediate period after birth. After 4 weeks postpartum the use of the levonorgestrel intrauterine device (IUD) is no longer restricted. After 6 weeks postpartum the use of all other progestogen-only contraceptive methods are no longer restricted. These recommendations are based on the belief that progestin-only contraceptive use could have a negative impact on the baby’s developing brain (WHO 2008a). The qualifications “generally” and “usually” mean use of the method is recommended only when other “more appropriate methods are not acceptable or available” (WHO 2008b).

Do combined hormonal contraceptives affect lactation?

A “Combined” hormonal contraceptive contains both estrogen and progestin. The existing data from randomized controlled studies does not clearly prove or disprove an effect of combined hormonal contraceptives on lactation (Truitt 2003).

What does combined hormonal contraceptives affect?

In some studies mothers who used contraceptives with both estrogen and progestin made less breastmilk (Truitt 2003). Infant growth has also been affected when mothers used contraceptives with both estrogen and progestin (Truitt 2003).

The quality of the evidence is not ideal

Little of the information regarding contraceptives on breastmilk production and infant growth is ideal. Significant problems include small numbers of women and babies, non-random assignment to treatment group, short follow up times, and high numbers of women and babies that did not complete the study. The most recent review concluded 1) the data on the effect of combined contraceptives on breastfeeding is not clear but 2) infant growth is not affected (Kapp 2010a).
Do progestin-only contraceptives affect lactation?

High quality data to answer the question of whether a woman's breastmilk or her infant's growth is adversely affected when she uses progestin-only contraceptives is not available. A review considered information from five randomized controlled trials and nearly 40 observational studies. All of the studies were considered fair to poor. Overall, women using progestin-only contraception in the postpartum period were able to breastfeed without problems for 12 months (Kapp 2010b). This same review showed that:

- Overall the progestin-only contraceptives caused no ill effects on breastfeeding or when started at 6 weeks or 6 months after delivery.
- In some randomized and observational studies women stopped breastfeeding sooner in the progestin-only group.
- In other studies women stopped breastfeeding later in the progestin-only group.
- In some studies women used more supplements in the progestin-only group.
- In many studies infant growth, health and development was normal from 6 months to 6 years.
- In some studies infant weight gain was lower and in some infant weight gain was higher when mothers used progestin-only contraceptives.
- Two male infants whose mothers were taking desogestrel pills had temporary breast enlargement.

A few studies have been published since the last review. One study looked at the effect of placing a progestin intrauterine system 10 minutes after delivery of the placenta versus after 6 weeks postpartum. Significantly less mothers and babies were breastfeeding at 6 months in the women exposed to progestin in the early postpartum period at 6 weeks (Chen 2011).

Recommended Child Spacing

The WHO recommends couples wait at least 24 months after birth to become pregnant again. This is because there are negative consequences for both mothers and babies when there is a short interval before the next pregnancy. Mothers are at a higher risk of dying when they become pregnant within 6 months of birth. Infants are at a higher risk of dying if they are born to a mother who became pregnant within 18 months of birth. Infants are also at risk of being preterm (born before 37 weeks gestation), small (birth weight less than the 10th percentile for gestational age), and low birth weight (birth weight less than 5 pounds 8 ounces or 2500 grams). After spontaneous and induced abortions the WHO recommends women wait at least 6 months to become pregnant again (WHO 2007).

Postpartum contraception

After delivery every woman should understand the recommendations for child spacing and her contraceptive options. A breastfeeding mother should consider the contraceptives potential effects on her breastmilk, her own health and the health of her baby.

Lactational Amenorrhea Method (LAM)

The Lactational Amenorrhea Method of contraception takes advantage of the delay in return of ovulation after birth when mothers are fully breastfeeding (Labbok 1997). Mothers answer three questions.

1) Is your baby older than 6 months of age?
2) Have your menses returned?
3) Are you supplementing regularly or allowing long periods without breastfeeding, more than 4 hours during the day or more than 6 hours during the night?

**Pregnancy rates with LAM**

If the answer to each of the three questions is “no”, the likelihood of pregnancy is low and LAM can be used as a contraceptive method. Using LAM fewer than 2 percent of women will become pregnant (Labbok 1997). There are no restrictions on the use of LAM and it has not been demonstrated to have any negative effects on breastfeeding or infant health (WHO 2009). Breastfeeding mothers around the world are satisfied with the LAM (Hight-Laukaran 1997). LAM has the added benefit of encouraging exclusive breastfeeding and supporting women to breastfeed for the internationally recommended minimum of two years.

**Can LAM work for mothers working outside the home?**

LAM may not be as effective for working mothers who are separated from their babies. Working mothers have higher pregnancy rates using LAM, about 5 percent compared to about 2 percent for nonworking mothers using LAM (Valdéz 2000).

**Note.**

Progestogen-Only Pills or Progestin-Only Pills are contraceptive pills that contain only synthetic progestogens (progestins) and do not contain estrogen. They are colloquially known as mini pills.

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GALACTOGOGUES

March 2012

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Explore factors that impact milk production

When mothers ask about galactogogues in the context of insufficient milk production, it is essential to go back to the basics of milk production. ALL physiological factors (inadequate milk removal, supplementation, maternal and infant health conditions) and psychological factors (depression, anxiety, separation, exhaustion) that impact milk supply and production should be explored and addressed first.

Case for galactogogues weakening

The Academy of Breastfeeding Medicine aptly summed up galactogogues when it said, “As new evidence has emerged regarding various interventions to increase milk supply, the case for using pharmaceutical galactogogues has grown weaker” (ABM 2011).

Only use up-to-date resources

The next most important step to take when counseling a mother about medications is to use an up-to-date comprehensive reference, which includes specific breastfeeding information. Most pharmaceutical reference material does not provide adequate information about effects on the breastfeeding mother and infant.

Lactmed

A free online searchable database is available at the National Library of Medicine TOXNET website http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?LACT. The easiest way to access the database is to enter LACTMED in your browser’s search bar. The contents are peer reviewed and references are included. Free iPhone/Android applications are available.

Infant Risk Center

Another resource is the Infant Risk Center directed by Thomas W. Hale, RPh, PhD and accessible at www.infantrisk.com. Health care professionals (including LLLI Leaders) can submit questions by phone 1-806-352-2519, or on the web forum where you can expect responses from staff within 24-48 hours. The public can search and review posts. An iPhone/Android application containing regularly updated information from Dr Hale’s database is available for purchase for an annual fee.

The Breastfeeding Network

The Breastfeeding Network has Drug Info Factsheets available online at http://www.breastfeedingnetwork.org.uk/drugs-in-breastmilk-information-and-factsheets.html. Specific questions will be answered by phone at the Drugs In Breastmilk Helpline 0844 412 4665 or by email at drug-information-2011@breastfeedingnetwork.org.uk.
Books

For areas with limited or unreliable access to technology, the books Medications and Mothers Milk by Thomas Hale and Drugs in Pregnancy and Lactation by Gerald Briggs, Roger Freeman and Sumner Yaffe, are indispensable resources. Both books categorize medications by risk, discuss how the drug works, estimate infant exposure, and summarize available evidence. The Drugs in Pregnancy and Lactation text also has a mobile application and searchable updated online site. Always use the most recent edition available.

Avoid outdated resources

Avoid older resources that are not regularly updated and do not include the most recent information. Older references include the Breastfeeding and Maternal Medication Recommendations for Drugs from the WHO and UNICEF published in 2002 and the American Academy of Pediatrics (AAP) policy statement “The Transfer of Drugs and Other Chemicals into Human Milk” retired in 2010.

Use caution

The third most important step when discussing medications with a breastfeeding or pregnant mother is to use caution. Medications and the uses they are approved for vary from country to country. Medications might not be approved for any use, or only for specific uses, for example:

- Domperidone is not Food and Drug Administration (FDA) approved for any use in the United States.
- Metoclopramide is FDA approved for gastrointestinal uses but not breastfeeding uses in the United States.

When a legal medication is prescribed for an unapproved use it is referred to as being prescribed “off label”. Galactogogues have been associated with serious side effects and death.

Academy of Breastfeeding Medicine Protocol

The Academy of Breastfeeding Medicine (ABM) Clinical Protocol #9: “Use of Galactogogues in Initiating or Augmenting the Rate of Maternal Milk Secretion” is a must-read resource for anyone discussing galactogogues. It is available for free at the AMB website www.bfmed.org in the Protocols and Statements section.

Limited high quality data demonstrating effectiveness, except in select populations, and significant side effects have caused the ABM to change its position on the use of galactogogues in the last decade. The “ABM cannot recommend any specific pharmacologic or herbal galactogogues at this time” (ABM 2011). According to the current policy statement “we should exercise more caution in recommending these drugs to induce or increase the rate of milk secretion in lactating women, particularly in women without specific risk factors” (ABM 2011).

How galactogogues might work

Despite the current ABM recommendation, domperidone and metoclopramide continue to be used to try to increase milk production. Both are dopamine antagonists. Dopamine inhibits the release of prolactin by the pituitary in the brain. Medications that cause the opposite effect,
called dopamine antagonists, increase prolactin release and raise maternal prolactin levels in
the blood (ABM 2011). In theory higher prolactin levels should lead to an increase in milk
production. Prolactin levels are higher in women who take domperidone or metoclopramide
(ABM 2011). However, there is no data linking prolactin levels with milk production (ABM
2011). While it is plausible that domperidone and metoclopramide increase milk production,
it is also possible that some of the effect of prescription galactogogues is likely to be a placebo
effect. Unfortunately the evidence does not definitively address all the questions surrounding
galactogogues at this time.

Much of the data on both domperidone and metoclopramide is limited by a lack of blinded,
randomized studies and by small numbers.

**Domperidone after preterm birth and cesarean delivery**

In select populations domperidone works; it has been shown to increase milk production for
mothers of preterm infants expressing their milk (Campbell-Yeo 2010, Wan 2008, Toparre
1994). In one small study of women without milk supply issues, domperidone increased milk
production after cesarean delivery (Jantarasaengram 2012). Whether this effect on milk
production can be applied to other populations, for example a mother with a term infant who
is not exclusively expressing milk, remains to be seen. Mothers are typically prescribed 10 mg
of domperidone to be taken orally three times a day (ABM 2011). Serious side effects in the
mother include cardiac arrhythmias, which can cause death (Anderson 2007). There are no
known side effects for the infant (Lactmed).

**Domperidone side effects**

Domperidone is approved for use and available in some countries for the treatment of specific
gastrointestinal problems. According to the FDA, domperidone is not approved for enhancing
breast milk production in any country (www.fda.gov, query domperidone, FDA Warning) even
if mothers have been able to obtain it off-label or off-list. Domperidone is not FDA approved
for any use in the United States and it is no longer available from compounding pharmacies
in the United States. In 2004 the FDA released a warning “not to use an unapproved drug,
domperidone, to increase milk production” because of the “potential public health risks” (FDA
Warning 2004). The FDA also notified several pharmacies and drug supply companies that
compounding and importing domperidone are both illegal activities in the United States (FDA
Talk Paper, June 7, 2004). Physicians who wish to prescribe domperidone in the United States
for gastric motility problems must complete an Investigational New Drug application with
the FDA.

**Metoclopramide**

The evidence-based data demonstrating a positive relationship between milk production and
metoclopramide is even less convincing. None of the randomized controlled trials have
demonstrated a positive effect on milk production when compared to a placebo. This is
contrary to the findings on some older less well-designed studies (ABM 2011, Anderson 2007).
The ABM has concluded that metoclopramide’s effect on milk production is not clear (ABM
2011). The typical dose is 10 mg orally three to four times a day for 7-14 days. Side effects
can be significant and include depression and tardive dyskinesia or abnormal, involuntary move-
ments, typically of the face muscles, which can be irreversible. The only reported adverse effects
in infants are gas and intestinal discomfort (Lactmed).
Focus on optimal breastfeeding practices

Assisting mothers to achieve optimal breastfeeding practice is imperative. At least one study has shown maternal counseling about “perfect breastfeeding” to be as effective as metoclopramide (Sakha 2008). Focus your discussion with the mother on the importance of regular effective milk removal.

References


Milk Expression

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MILK EXPRESSION

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Worldwide breastfeeding recommendations

The World Health Organization (WHO) recommends exclusive breastfeeding for six months and continued breastfeeding for a minimum of two years (WHO 2002). The WHO has ranked the possible breastmilk feeding options as follows: 1) direct breastfeeding at the mother’s breast, 2) mother’s fresh expressed breastmilk, and 3) mother’s expressed breastmilk previously refrigerated or frozen (WHO 2002).

Sometimes mothers must express breastmilk to achieve their breastfeeding goals and to be able to breastfeed for the recommended duration. The ultimate goal of milk expression is to help the mother breastfeed her baby by getting her baby to or back to the breast.

When expressing breastmilk is necessary

First and foremost mothers need encouragement and support to breastfeed. Our second obligation is to help mothers provide expressed milk when they are unable breastfeed. Caution is warranted to ensure we don’t portray pumping as a requirement to successful breastfeeding for all mothers. While providing expressed breastmilk is beneficial, there are additional benefits to directly breastfeeding. Help every mother who must be separated from her baby by encouraging her to put her baby to her breast when it is a feasible option for her and her baby. Options will depend on whether there are physical problems such as a cleft lip and palate, or if mother and baby are separated due to hospitalization or mother’s employment.

Review of the research comparing various breast pumps to each other and to hand expression, found no significant difference in the following factors: maternal satisfaction, adverse events, bacterial contamination, milk volume. There is no specific type of pump (manual or electric), method of expression (hand versus pump, simultaneous or sequential expression) or suction pattern that mothers prefer (Cochrane 2011).

Mothers have many factors to consider when selecting a method of milk expression. These factors influence the desirability, acceptability and effectiveness of the chosen milk expression technique. The data does not clearly indicate if hand expression, manual, or electric pumps are superior for any particular mother. Information about low cost methods like breast massage and relaxation should be explored and discussed along with hand expression and pumping. The most suitable method for milk expression may depend on the time since birth, purpose of expression, location of expression and the individual mother and infant (Cochrane 2011).

Choose a pump with different sized flanges or breast shields

Some pumps have the option of different sized breast shields or flanges. A well fitting flange will allow for comfortable pumping and a good flow of milk. A mother should be comfortable both while pumping and afterward. While pumping, she should see her nipple moving easily in the tunnel of the flange, pulling her areola slightly with it. Her nipple should not rub against the sidewalls of the flange (Jones 2009).

When a baby is hospitalized

When infant illness or prematurity requires prolonged hospitalization, a mother may be unable to feed her baby directly at the breast for some time. In this situation focus on establishing an ample and full milk supply. This is best done and most easily explained by helping the mother start and maintain a milk expression pattern that closely resembles what a healthy term infant would do naturally.
Maximum total milk production is set early in lactation so have a mother focus her efforts on regular breast stimulation and milk removal. Mothers should begin expressing as soon as possible after birth. Regular breast stimulation at a minimum of 8–12 times per 24 hours or approximately every 3 hours, including through the night is ideal until lactation is well established. Acknowledge that for some mothers it will be difficult to achieve 12 expression sessions, especially when there are other children that need her attention or when her new baby is hospitalized. Explore ways, such as expressing every 2 hours for a period to allow for a 4-hour period without expressing, that might allow her to fit in the recommended number of sessions.

The best method for milk expression is not clear (Cochrane 2011). During the initial post partum period before the onset of copious milk production milk volumes are small and hand expression might be as or more effective and comfortable (Ohyama 2010 and Flaherman 2011). When prolonged milk expression will be required, most experts recommend an electric hospital grade multi-user pump to allow a mother to express her breasts simultaneously, which has been shown to save time. Hands on pumping significantly increases the volumes expressed (Morton 2009). Hands on pumping or breast compression during pumping can be viewed at http://newborns.stanford.edu/Breastfeeding/MaxProduction.html

Importance of milk ejection reflex (MER)

Regardless of expression method, stimulating the milk ejection reflex is key. Eighty-five percent (85%) of the total volume expressed occurs during the first two milk ejection reflexes (Kent 2008). Suggest mothers pump for two minutes after the last flow is seen, for a minimum of about 15 minutes. More frequent shorter pumping sessions are more effective than fewer longer pumping sessions. Using relaxation techniques such as structured breathing taught for use during labour and visualization can help. She might picture a relaxing setting like a warm beach with her baby snuggled close to her and her milk flowing like a waterfall. A mother can use photos and recordings of her baby, and his clothing for tactile and olfactory reminders to help stimulate her milk ejection reflex. Relaxation techniques have been shown to improve milk yield (Cochrane 2011). Over time mothers often become conditioned to having a let down to the pump.

Regular separation of mother and her baby

Many breastfeeding mothers who are regularly separated from their babies, for example when working outside the home, choose electric single-user pumps capable of pumping both sides simultaneously. Other women are able to maintain milk production by hand expressing while away at work and breastfeeding when with their baby (Valdes 2000). Some mothers find improved success when hand expression is combined with pumping (Morton 2009).

A mother can aim to express in a pattern similar to her baby’s typical breastfeeding rhythm. Breast storage capacity and infant nursing style varies widely. Encourage each mother to design a breastfeeding and expressing regimen that works for her and her baby.

Occasional separation of mother and her baby

Some women will want to occasionally express milk for their infant either for a temporary separation like a doctor’s appointment or to have expressed milk available to mix with complementary foods. In this situation hand expression or a small, single-user manual or battery-operated pump that can express one or both breasts at the same time is fine.
How can we best support women who choose to express their milk?

By teaching mothers hand expression, helping them to choose among the different classes of breast pumps, and assisting with designing an expressing regimen to protect milk production so each mother will have an ample milk supply when her baby is able to breastfeed directly at the breast. Breast storage capacity and infant feeding patterns vary significantly amongst mothers and babies so suggest a mother try to reproduce her baby’s feeding rhythm/pattern when she is away from her baby and expressing/pumping. Suggest she begin expressing several weeks before returning to work.

Information and data about expressing and pumps needs to be interpreted cautiously; much of the research on pumping is supported by pump companies. Also many of the studies suffer from the typical biases of small numbers, inadequately powered to answer the question, lack of randomization and blinding – in addition to commercial funding.

We cannot assume all breastfeeding benefits documented for a mother and baby will be provided from expressed milk. While praising mothers for their efforts to provide expressed milk for their infants, stress the benefits from and importance of direct breastfeeding.

References

Jones E, Hilton S. Correctly fitting breast shields are the key to lactation success for pump dependent mothers following preterm delivery. Journal of Neonatal Nursing. 2009;15:14-17.


Expressed human milk is better than formula

Put another way, formula exposes babies to risks that breastfed babies do not face (Bartick 2010). Current evidence does not address every specific question about milk storage that arises when a mother is expressing and storing milk for her baby. The evidence does show that breastmilk keeps many of its nutritional and immunologic benefits even when stored (Pardou 1994, Rechtman 2006). Breastmilk remains the preferred feeding choice (World Health Organization (WHO) 2002). The WHO recommends that babies be breastfed for a minimum of two years. Expressing and storing human milk not only enables but also is necessary for many women to reach that goal (WHO 2002).

Hand washing reduces bacterial contamination

It is a good idea when possible for a mother to wash her hands before breastfeeding, just as she would wash her hands before eating or preparing food. Washing her hands before expressing her milk is an important way to reduce the chances of her breastmilk becoming contaminated with bacteria from her hands (CDC 2010). She does not need to wash her breasts before expressing milk (ABM 2010). If she has used a medication or ointment on her breasts that is compatible with breastfeeding, there is no need to remove it before expressing.

Breastmilk is not sterile

It has lots of components including beneficial or nonpathogenic bacteria. These bacteria work to inhibit the growth of pathogenic or infection-causing bacteria (Heikkilä 2003). During expression bacteria from a mother’s skin and her nipples enter the expressed milk (Heikkilä 2003). The factors that discourage the growth of bacteria in a baby’s intestines also guard against bacterial growth when the milk is stored in a container (Rechtman 2006).

Use a clean container to collect expressed milk

It is important that the container for collecting expressed milk is clean. The container can be washed with hot soapy water or in the dishwasher. Some containers used for expressing and storing milk that are available for purchase have been sterilized during production and can be used directly out of the package. Instructions are included in the package insert (ABM 2010).

Choosing a storage container

Many options exist in storage containers: glass, metal, various types of hard plastic and flexible plastic bags. Each type of container has different advantages and disadvantages (ABM 2010). The mother will need to take into account many factors when choosing a storage container including: cost, ease of use, reusability, disposability, storage space, need for transport, breakability, contamination risk, and effect on milk quality. She should only use containers that are meant for food usage and that meet the newest safety recommendations. This will eliminate, for example, glass or pottery that contains lead and plastics that contain chemicals such as bisphenol A (BPA). BPA is an endocrine disrupter and there is concern it might have effects on the brain, behavior, prostate and mammary glands in children (National Toxicology Program 2007). Plastics labeled with the recycling symbol and #1,2,4 or 5 and/or PP are BPA and phthalate free. Plastics labeled #3,6 or 7 should not be used (Caring for Our Children...
Mothers might use different types of storage containers for different uses. Her childcare center may have policies that dictate disposable or reusable storage containers or she might prefer bags when traveling and glass at home.

**Volume of milk to store per container**

Suggest a mother put only 2–4oz (60–120 ml) of expressed milk in each container, as that is the amount her baby is likely to eat in a single feeding. Small quantities are easier to thaw, reduce waste and discourage caregivers from overfeeding. She can adjust her milk storage volume as her baby’s needs change. If container cost or storage space is an issue, an alternative approach is to “fill” each container. When using bags, squeeze as much of the air out as possible. Milk will expand as it freezes so allow about 1 inch (2.5 cm) of room for expansion at the top of the container (LLLGB 2010).

**Milk Smell**

Some milk has a soapy or rancid smell after cooling or freezing. This is likely due to lipase in the milk. Lipase is an enzyme that helps in the digestion of breastmilk by breaking down the fats. There is disagreement on what to do in this situation. Some babies are not bothered by the smell. If a baby refuses the milk, it can be scalded before freezing to deactivate the lipase (Lawrence 2005). To scald expressed milk before freezing, warm the milk in a pan on the stove until tiny bubbles form around the edge of the pan (Lawrence 2005). Some experts do not recommend heating breastmilk over 104°F (40°C) because it can reduce the nutritional and immunologic benefits (ABM 2010).

**Label the milk**

Label the expressed milk with the date of collection, including year if freezing. If the mother is expressing and planning on breastfeeding for the recommended minimum duration of two years, she might have expressed milk from the same month in more than one year. She will need to know if the bag found at the back or bottom of the freezer was from this December or last December. If her baby is cared for outside the home or with other babies, she will need to add her baby’s name to the label.

**Should a mother refrigerate or freeze her expressed milk?**

The answer depends on how much milk the mother is expressing and on how much expressed milk her baby is consuming. Milk does lose some nutritional and immunological benefits during refrigeration, freezing, and reheating (ABM 2010). The preferred feeding order would be: at the breast, fresh expressed human milk, previously refrigerated human milk, previously frozen human milk. Try to take into account her baby’s intake and balance that with her expressed volume. Refrigerate expressed milk that will not be consumed immediately. Freeze milk as soon as possible if it will not be consumed within 8 days (Pardou 1994). Consider donating to a milk bank if you are likely to have milk that will not be used within one year.
Mixing previously and newly expressed milk

The safest way to mix previously expressed and newly expressed milk is to cool the newly expressed milk to the same temperature as the previously expressed milk, then add cold milk to cold milk (ABM 2010). If adding freshly expressed milk to frozen milk, cool the expressed milk before adding to frozen milk and make sure there is less fresh milk than frozen milk.

Ideal and safe storage times

The following guidelines apply to mothers who have healthy, full-term babies. Hospital staff can provide information on stricter storage guidelines for premature or sick babies in hospital. Conflicting opinions exist about ideal and acceptable safe storage limits for expressed human milk (Hands 2003). Research has not answered all the questions about appropriate storage times for expressed breastmilk for all temperatures. Storage temperature determines storage time. Ideal and acceptable storage times in various conditions are listed in the table (ABM 2010). When longer storage times are anticipated it is best to store milk at cooler temperatures (Silvestre 2006).

Research clearly demonstrates that human milk stored for shorter periods of time (ideal) is preferable to that stored for acceptable times. Anti-infective properties and nutrients, such as vitamin C, decline with storage time. Ideal storage times coincide with points where research has shown a significant drop in anti-infective properties, associated with increased growth of any bacteria added to the human milk for testing.

Human milk is definitely better than formula and still safe, when stored longer. All babies will benefit by having fresher milk whenever possible, particularly if there is illness in the family or if babies are getting mostly or only expressed milk.

Temperature

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Storage Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOM TEMPERATURE 60°–85°F (16°–29°C)</td>
<td>4 hours ideal, 8 hours acceptable</td>
</tr>
<tr>
<td>ICE PACKS IN COOLER 50°–59°F (10°–15°C)</td>
<td>10 hours ideal, 24 hours acceptable</td>
</tr>
<tr>
<td>REFRIGERATED &lt;39°F (&lt;4°C)</td>
<td></td>
</tr>
<tr>
<td>FREEZER COMPARTMENT OF REFRIGERATOR &lt;5°F (&lt;-15°C)</td>
<td></td>
</tr>
<tr>
<td>FREEZER &lt;0°F (&lt;-17°C)</td>
<td></td>
</tr>
</tbody>
</table>

Storage Time

<table>
<thead>
<tr>
<th>Storage Time</th>
<th>Fresh milk</th>
<th>Previously frozen milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOM TEMPERATURE</td>
<td>72 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td>ICE PACKS IN COOLER</td>
<td>2 weeks</td>
<td></td>
</tr>
<tr>
<td>FROZEN</td>
<td>6 months</td>
<td>12 months</td>
</tr>
</tbody>
</table>
Using expressed milk

If the baby prefers warm milk, it is best to warm the milk by holding the container under warm running water or immersing the container in a bath of warm water for several minutes. For ideal warming, heat milk for less than 5 minutes, to a temperature of up to 98.6°F (37°C) in warm water at a temperature below 120°F (48.9°C) (CFOC 2011). Breastmilk should not be heated in the microwave or directly on the stove (CFOC 2011). Microwaving can lead to uneven heating that could burn the baby and significantly decrease the anti-infective properties of human milk (Hands 2003). Warming milk directly on the stove can lead to overheating and also denature proteins in the milk (Hands 2003). If the milk was previously frozen it is best to thaw it in the refrigerator and then warm in hot water.

Re-feeding partially consumed milk

Bacteria in the baby’s mouth can enter the bottle during feeding and multiply in the milk. Antibacterial components in milk hamper bacterial growth. Although we have not found any formal studies to provide recommendations for this situation; based on related evidence, it seems reasonable to discard the remaining milk within 1–2 hours after the baby has finished feeding. Use a fresh bottle of milk if the next feed is more than a couple of hours later (ABM 2010, LLLI 2008). Milk that has been previously frozen will have lost some of its antibacterial properties and should be discarded soon after feeding.

Re-cooling expressed milk

Once stored expressed milk has been warmed to room temperature or above, it is best not to return it to either refrigerator or freezer temperatures (ABM 2010). Frozen milk cooled to refrigerator temperatures for less than 8 hours is safe to refreeze (Rechtman 2006).

Maternal breast infection and storing milk

If a mother has a bacterial or fungal infection of her breast she can continue to breastfeed. There is debate about whether or not she should store expressed milk for use at a later date (LLLI 2008, ABM 2010). If a mother has breast or nipple pain from what is considered to be a bacterial infection, there is no evidence that her stored expressed milk needs to be discarded unless it appears stringy, foul or contains pus (ABM 2010). With a fungal infection, the safest course of action would be to discard any milk expressed during the infection until the full course of treatment is completed (LLLI 2008).

References


