



The Increasing Importance of Human Milk Banks

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ABSTRACT

Background: Human milk is recognized as the optimal feeding for newborn infants. Recent national and worldwide efforts have publicized the benefits of human milk for infant growth and reduction of disease and malnutrition. The Mother's Milk Bank at Rocky Mountain Hospital for Children in Denver, CO. is an example of established practices to increase the safety and availability of milk for high-risk infants. The history of milk banking and the key steps involved in donation, processing and dispensing of human milk are outlined.

Key Words: breast milk, milk bank, premature infant

INTRODUCTION

The use of human milk as the primary source of nutrition for infants has received increased support over the past decade from both international and national groups. The World Health Organization (WHO), United Nations Children's Fund (UNICEF) and the American Academy of Pediatrics (AAP) have all issued statements declaring the importance of human milk for optimal infant feeding.¹⁻³ Recently the U.S. Surgeon General, Dr. Regina Benjamin, issued a "Call to Action to Support Breastfeeding".⁴ This position paper highlighted the health, economic and psychosocial benefits of breastfeeding, the incidence and length of breastfeeding in the United States, barriers to success and governmental, healthcare and

societal initiatives to reverse these trends. These combined efforts by multiple agencies have led to the development of strategies to reduce the commercialization of infant nutrition by decreasing the marketing of infant formulas particularly in health facilities, by encouraging breastfeeding and increasing awareness and promotion of human milk banks to provide donor milk when mothers are unable to produce adequate milk for their infants.

The worldwide initiative to reduce infant mortality by promoting human milk feeding was developed to reduce infant death, malnutrition and chronic illness, particularly in developing countries. Even in

industrialized countries such as the United States it is postulated that the incidence of diarrhea and otitis media and their associated health care costs would be reduced by increasing breastfeeding incidence and duration.² Childhood obesity and the increase in diabetes mellitus have also been linked to a decline in breastfeeding practice in the US.⁵ Human milk is known to contain important immunologic, enzymatic, hormonal and endocrine factors which are absent in commercial formulas and contribute to improved gastrointestinal maturation and function. Recently, studies in preterm infants have shown improved feeding tolerance, lower infection risks and a decreased rate of necrotizing enterocolitis with an exclusive human milk diet.⁶⁻¹⁰ This has led to innovative clinical practices in neonatal intensive care units utilizing maternal and donor human milk and, recently, human-milk based preparations as fortifiers for this high risk population. Recent cost analyses have reported health care savings using exclusive human milk feedings in preterm infants by reducing the incidence of necrotizing enterocolitis and hospital length of stay.¹¹ There are also maternal health benefits from breastfeeding as well as societal and environmental advantages.

The challenges to encouraging universal breastfeeding and the use of human milk are multifactorial, including cultural and commercial pressures. Detailed recommendations have been developed to support improved education and resources to promote human milk as the best and sole nutritional source for infants. The use of pasteurized human milk is advocated when mothers are unable to produce adequate milk, especially for the premature and high-risk infant population. "The best food for a baby who cannot be breastfed is milk expressed from the mother's breast or from

another healthy mother. The best food for any baby whose own mother's milk is not available is the breastmilk of another healthy mother."² In an editorial, Wright wrote, "Where it is not possible for the biological mother to breastfeed, the first alternative, if available, should be the use of human milk from other sources. Human milk banks should be made available in appropriate situations."¹²

HISTORY

Historically "wet nursing" was the first form of human milk donation where infants were breastfed by women other than the mother. This tradition lost favor with the recognition of potential disease transmission and the formulation of artificial infant feedings. With improved sanitation and the development of refrigeration, a few human milk banks were established in the early 1900s. The emergence of the human immunodeficiency virus in the 1980s resulted in closure of milk banks due to the risk of viral transmission and the increased requirements for screening donors and complexity of processing milk. The Human Milk Banking Association of North America (HMBANA) was established in 1985 to establish professional guidelines for human milk banking practices, education and research in the US, Canada and Mexico. It is "a multidisciplinary group of health care providers that promotes, protects, and supports donor milk banking."¹³⁻¹⁵ It acts as a liaison between milk banks and governmental agencies and provides regulatory oversight and information sharing among members. HMBANA is a nonprofit organization that has developed rigorous standards for the 11 member milk banks to screen donors, collect, process and dispense human milk. Five more milk banks are in development in the US and Canada. Most are associated with hospitals. (Table 1)

The Mother's Milk Bank (MMB) at Rocky Mountain Hospital for Children at Presbyterian/St. Luke's Medical Center (P/SL) is a nonprofit program that has been in existence since 1984.¹⁶ It has expanded significantly in its 27 years, providing over 300,000 ounces of milk in 2010. Potential donors hear about the program when delivering infants at P/SL, through childbirth educators, lactation consultants and outreach

potential infectious diseases, following the American Association of Blood Banks (AABB) standards for screening blood donors.¹⁷⁻¹⁸ The mother's obstetrical and lactation history is reviewed, including pregnancies, milk production, diet and medications. Donors should be in good health, non-smokers, not taking medications (with specific exceptions such as vitamins, thyroid replacement hormones, insulin),

Table 1: HMBANA Milk Bank Locations

Milk Bank	Location	Phone Number
BC Women's Milk Bank	Vancouver, BC	604-875-2282
Mothers' Milk Bank	San Jose, CA	408-998-4550
Mothers' Milk Bank P/SL and Rocky Mountain Hospital for Children	Denver, CO	303-869-1888
Mothers' Milk Bank of Florida	Orlando, FL	*
Indiana Mothers' Milk Bank, Inc.	Indianapolis, IN	317-536-1670
Mothers' Milk Bank of Iowa	Coralville, IA	319-356-2652
Bronson Mothers' Milk Bank	Kalamazoo, MI	269-341-8849
Mothers' Milk Bank of Mississippi	Madison, MS	*
Kansas City Regional Human Milk Bank	Kansas City, MO	*
Mothers' Milk Bank of New England	Newtonville, MA	617-527-6263
WakeMed Mothers' Milk Bank and Lactation Center	Raleigh, NC	919-350-8599
Mothers' Milk Bank of Ohio	Columbus, OH	614-544-0810
Ontario Human Milk Bank	Toronto, ON	*
Northwest Mothers' Milk Bank	Portland, OR	*
Mothers' Milk Bank at Austin	Austin, TX	512-494-0800
Mothers' Milk Bank of North Texas	Ft. Worth, TX	817-810-0071

*Milk banks currently in development

efforts by MMB as well as internet searches. Many of these mothers produce milk in excess of their infant's needs, while others may donate milk after their baby has expired.

PROCESSING

The key steps in milk bank donation and processing are outlined in Table 2. Candidates for milk donation are screened with detailed telephone and written questionnaires about health history and

have limited caffeine intake and avoidance of alcohol within a specified time period, have medical release by a physician provider and be able to commit to donation of a minimum volume of milk. Candidates undergo blood testing for viral diseases according to the AABB guidelines. Donors do not receive financial compensation for their milk. The process is intended to maintain confidentiality and also to be convenient for the donors. The donation approval process takes 1-2 weeks.

Table 2: Key Steps in Human Milk Banking

	Step
1.	Donor identification and screening, including detailed history and blood testing.
2.	Donor milk is delivered frozen to the milk bank.
3.	Milk is thawed and pooled among multiple donors.
4.	Milk is pasteurized using a water bath of 62.5°C for 30 minutes.
5.	Bacterial cultures of pasteurized milk are performed to ensure sterilization.
6.	Analysis of donor milk for fat, protein, carbohydrate and lactose content using the Milkoscope. Caloric calculations provide different milk formulations.
7.	Pasteurized milk is frozen in -20°C freezers.
8.	Human milk is dispensed by physician prescription. Costs include processing and shipping fees. Donors do not receive financial remuneration.

Mothers are instructed in recommended techniques for expressing and storing milk for donation, including good hand-washing, using clean containers and labeling the bottles with the date collected. The milk is frozen and brought to the milk bank or to an outlying depot. The milk bank pays for shipping frozen milk in insulated containers on dry ice to the center, where it is stored in large freezers at -20°C or colder. Milk is received from the depots located in Denver, Littleton, Boulder, Ft. Collins, Colorado Springs and Greeley within Colorado, as well as Kansas City, Salt Lake City and two hospitals in Portland, Oregon.

Milk is thawed and pooled among multiple donors into glass flasks. (Figure 1) It is then poured into two or four ounce sterilized glass bottles in preparation for pasteurization. The milk is heat-treated by placing the bottles into a water bath with a temperature minimum of 62.5°C for 30 minutes, killing bacteria and viruses but preserving the other biologically active immune factors and hormones present in human milk. (Figure 2) Following

pasteurization a bacterial culture is taken to ensure sterilization and the milk is analyzed for fat, protein, carbohydrate and lactose content using a Milkoscope (Figure 3, Scope Electric, Razgrad, Bulgaria). Caloric content is calculated for each batch. (Figure 4) The pasteurized milk is cooled, labeled and placed in -20°C freezers where it can be stored for a year from the date that it was expressed from the donor mother. (Figure 5)

Human milk is available in several formulations including term milk, early term milk (colostrum, 7-10 days postpartum), preterm, non-fat (0-0.3% fat for treatment of infants with chylothorax), nondairy and several caloric densities from 20 to 24 kcal/oz. It is dispensed according to medical need by physician prescription to any location in the United States. Recipients are charged processing and shipping fees which help to defray the costs associated with screening donors, handling and sterilizing the milk.

Candidates for donor milk include infants whose mothers cannot supply sufficient milk

as well as specific medical needs such as prematurity, allergies, failure to thrive, immune deficiencies, gastrointestinal disorders and metabolic diseases. Some families adopting infants have requested donor milk for their babies as well.



Figure 1: Pooled donor milk is dispensed in glass bottles prior to pasteurization.

Frozen milk is distributed by courier to local metropolitan Denver hospitals and shipped frozen on dry-ice to greater distances Monday-Thursday, usually by next-day delivery. Hospitals and other recipients are charged a \$3.50/ounce processing fee plus shipping costs. There is potential for insurance coverage, financial aid and other payment options. MMB follows the guidelines prescribed by the HMBANA who



Figure 2: Milk is pasteurized in a water bath $> 62.5^{\circ}\text{C}$ for 30 min

provides oversight of the program during annual evaluations. The office and laboratory space occupy 3000 square feet adjacent to Presbyterian/St. Luke's Medical Center. MMB employs seven staff including a director, lab techs, administrative office staff, accountant, outreach coordinator,



Figure 3: The Milkoscope measures milk contents

donor recruiter and database recorder. In addition there are multiple volunteers who contribute to the program. It is supported by the nonprofit Rocky Mountain Children's Health Foundation and receives financial support through grant funding from various groups in addition to revenue from routine processing fees. With the expansion of the program and the efficiencies gained by processing increasing volumes of donated milk the MMB has recently been able to reinvest monies in the program and the Foundation.

MOTHERS MILK BANK				
POOL #	FAT	PROTEIN	LACTOSE	CALORIES
3938	3.62	1.13	7.01	20.27
3939	4.59	1.19	7.16	23.24
3940	3.78	1.18	7.29	21.13
3941	3.97	1.13	6.92	21.13
3942	3.84	1.22	7.6	21.73

Figure 4: Pooled milk constituents measured by Milkoscope



Figure 5: Donor milk is frozen after processing

DISCUSSION

The increasing awareness of the value of human milk for infant nutrition and the vast availability of information and networking via the Internet has led to some unregulated commerce in the product. Human breast milk that has not been properly collected and tested by the rigorous HMBANA guidelines could lead to potential infections and health risks.¹⁹ Promoting the current human milk banks and developing new

centers should allow expansion of availability of this unique resource to our vulnerable populations of infants.

Recent scientific information reinforces the importance of human milk for optimal newborn nutrition and highlights the important “health, nutritional, immunologic, developmental, psychologic, social, economic, and environmental benefits.”³ Donor human milk banks play an important role in providing this ideal nourishment, especially for high-risk and premature infants. The Mother’s Milk Bank in Denver, Colorado, and others nationwide, has demonstrated the ability to safely collect and dispense donated milk to this population. Promoting and expanding milk banks dovetails with the worldwide effort to use human milk as the exclusive infant feeding. The 2011 Surgeon General’s “Call to Action to Support Breastfeeding” recommends systematic review of current safety and health benefits of banked donor milk, development of evidence-based guidelines for use of this valuable resource and establishment of federal guidelines for regulation and financial support of donor milk banks. “Growing evidence supports the role of donated human milk in assisting infants with special needs, such as infants in newborn intensive care units who are unable to receive their own mothers’ milk, to achieve the best possible health outcome. In these situations, use of banked donor milk may protect the infant from the risks that might result from not breastfeeding. Unfortunately, demand for donor milk outpaces supply because of logistical challenges related to transportation of donated milk, the lack of clarity in oversight, and the high cost of providing banked human milk. A national strategy is needed to efficiently and effectively address the issues involved in providing banked donor milk to vulnerable infant populations.”⁴

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