Human milk banking: One year experience from a tertiary care centre

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ABSTRACT

Introduction: A human milk bank (HMB) systematically collects, screens, processes, and dispenses excess milk donated by healthy nursing mothers. First HMB of Asia was established in the year 1989 in Mumbai, but there are still insufficient milk banks in India. **Objective:** This study aimed to provide our experience in the past 1 year. Methods: This retrospective descriptive study was conducted in the HMB of a tertiary care institution. The data were collected from donor forms and other milk bank records in the milk bank. All the demographic details and bacteriological data were collected. **Results:** There were 1168 donors with no extramural donors. Of these, 882 donors had term babies and 286 had preterm babies. The mean age of the donor population was 23.53±3.27 years. On the analysis of the volume of milk donated, the mean volume was 77.62±51.26 ml. A total of 90,660 ml of human milk was collected during the study period of 1 year. The bacteriological culture of the donor milk showed growth in 42 (3.6%) samples and was discarded. *Klebsiella* (2.39%) was the most common organism followed by *Escherichia coli* (0.44%) and *Staphylococcus* (0.35%). There were 1424 recipients and about 74% of them, were preterm babies. There were no extramural recipients. **Conclusion:** For a large number of preterm babies and the neonates without breast milk in India, pasteurized donor human milk will be the best source of nutrition. Hence, number of HMBs will improve the neonatal survival and reduce the morbidity.

Key words: *Breast milk, Donor, Human milk bank, Pasteurized donor human milk*

The advantages of breastfeeding and its immediate effects on neonatal survival and long-term effect on cognitive development in the baby have been well established by many studies [1-5]. Due to physiological and emotional problems, some mothers are not able to adequately produce milk. The World Health Organization (WHO), the United Nations International Children's Emergency Fund (UNICEF), and the American Academy of Paediatrics state that the use of donor human milk should be the first alternative when maternal milk was not available, particularly for preterm neonates [6,7]. Human milk bank (HMB) primarily started to provide donor human milk to high-risk newborns admitted in the neonatal unit. Use of a wet nurse, "a woman who breastfeeds another's child," was a very common practice before the introduction of the feeding bottle and formula feeds. Wet nursing began as early as 2000 BC and extended up to the 20th century when feeding bottles were introduced.

A HMB systematically collects, screens, processes, and distributes human breast milk donated by healthy nursing mothers [8]. The most important issue concerning HMBs is the bacteriological contamination of donated milk, as consumption of contaminated human milk may be the cause of neonatal diseases [9]. Microbiological screening of donor human milk is done before (if there is no cost constraint), and as soon as possible after pasteurization. Pre-pasteurization cultures can result in wastage of donor milk to the tune of about 30% in some cases [10]. A bacterial count of 10^5 CFU/mL or more in raw breast milk can be considered as an indicator of the poor quality of milk [6].

HMB was started informally a 100 years ago, and the first HMB of Asia was started in 1989 in Mumbai by Dr. Armeda Fernandez. However, there is still insufficient number of milk banks in India [6]. Our milk bank was started in August 2015. There are only a few papers available in the literature that shares their experience in the functioning of HMB. This article was aimed to provide our experience in the past 1 year.

METHODOLOGY

This was a retrospective descriptive study conducted in HMB of a tertiary care institution over a period of 1 year from January 2017 to December 2017. The data were collected from donor forms and other milk bank records in the milk bank. Our HMB follows standardized procedures for the collection and handling of the donated milk, and the consent of donor mothers was taken and documented. Donor mothers were motivated and counselled about milk donation by trained doctors and nurses. Donors were then instructed by the milk bank staff about breast cleaning

procedures. The study was approved by the Institutional Ethical Committee.

We rigidly followed the eligibility criteria for selecting the human milk donors as recommended by Indian Academy of Pediatrics - Infant and Young Child Feeding Chapter, which is available at www.iycfchapteriap.org [6] and shown in Table 1. Donor screening was meticulously done by detailed history, physical examination, and serological screening for human immunodeficiency virus, hepatitis B, and syphilis. Donors who did not fulfill the eligibility criteria were excluded from donating milk. We used mechanical breast pumps in our milk bank and pooled milk from two or three donors to the container reached the full capacity of 100 ml followed by pasteurization. Pooling ensures the uniform distribution of nutrients, such as protein and fat.

We employed the Holder pasteurization process of heating up to 62.5°C for 30 min [6]. After this, pasteurized milk undergoes a bacteriological culture to ensure the absence of bacterial growth. In the hospital microbiology lab, milk sample was inoculated to a blood agar plate and incubated at 36°C for 48 h; all contaminated milk with bacterial growth was discarded. The data were analyzed for frequency and mean. The relationship between the gestational age, donor's age, quantity of milk donated, and the bacteriological profile was analyzed using independent sample t-test and Fischer's exact test.

Table 1: Criteria for breast milk donors [6]

Who can donate?
A lactating woman who
Is in good health, good health-related behavior, and not regularly on medications or herbal supplements (with the exception of prenatal vitamins, human insulin, thyroid replacement hormones, nasal sprays, asthma inhalers, topical treatments, eye drops, progestin-only, or low dose estrogen birth control products);
Is willing to undergo blood testing for screening of infections; and
Has enough milk after feeding her baby satisfactorily and baby is thriving nicely.
Who cannot donate?
A donor is disqualified who
Uses illegal drugs, tobacco products or nicotine replacement therapy; or
Regularly takes more than two ounces of alcohol or its equivalent or three caffeinated drinks per day; or
Has a positive blood test result for HIV, HTLV, Hepatitis B or C or syphilis; or
Is herself or has a sexual partner suffering from HBV, HIV, HCV, and venereal diseases OR either one has high-risk behavior for contracting them in past 12 months; or
Has received organ or tissue transplant, any blood transfusion/blood product within the prior 12 months.
Is taking radioactive or other drugs or has chemical, environmental exposure or over the counter prescriptions or mega doses of vitamins, which are known to be toxic to the neonate and excreted in breast milk; or
Has mastitis or fungal infection of the nipple or areola, active herpes simplex or varicella-zoster infections in the mammary or thoracic region.

HIV: Human immunodeficiency virus, HTLV: Human T-lymphotropic virus, HBV: Hepatitis B virus, HCV: Hepatitis C virus

RESULTS

The results are tabulated in Table 2. There were 1168 donors during the study period. All the donor populations were mothers of babies admitted to our neonatal intensive care unit and mothers from the postnatal wards. There were no extramural donors in the study population, and 882 donors were with term babies and 286 donors with preterm babies. The mean age of the donor population was 23.53±3.27 years. More than three-fourth of the donor population was in the age group of 21–30 years. There were 3 mothers above the age of 41 years.

On the analysis of the volume of milk donated, the mean volume was 77.62±51.26ml. The bacteriological culture of the donor milk showed growth in 42 (3.6%) samples and was discarded. On analysis of cultures (Table 2), *Klebsiella* (2.39%) was the most common organism followed by *Escherichia coli* (0.44%) and *Staphylococcus* (0.35%). There was no statistically significant difference between the preterm and term group with regard to the age of mothers, amount of milk collected and bacterial growth. A total of 90,660 ml of human milk was collected during the study period, and there were total 1424 recipients (Table 3). About 74% (1054/1424) of the recipients were preterm babies, and the rest were term babies, and there was no extramural distribution of pasteurized donor human milk (PDHM).

DISCUSSION

The advantages of breast milk feeding to the neonates have been well known. The Baby-Friendly Hospital Initiative by WHO/UNICEF recommended that newborn babies should be breastfed within 30 min of birth, and exclusively given breastfeeding until 6 months of their age. Breast milk is the best food for neonates as it contains higher levels of antibodies and anti-infective factors that protect against infections [1]. Breastfeeding also promotes cognitive and neurological development in babies. Breastfeeding reduces the risk of neonatal diseases such as necrotizing enterocolitis, sepsis, and retinopathy of prematurity [1].

However, there are some instances where the mother cannot breastfeed her baby. PDHM will be the best alternative than formula feeds or animal milk [11]. The preterm neonate will be the greatest beneficiary of PDHM. While PDHM cannot replace the entire infant milk formula market in India, it will undoubtedly reduce the morbidity and improve the survival of preterm babies [12-15].

In a few well-established HMBs there were many extramural volunteers who were motivated by voluntary agencies to donate milk and the voluntary agencies collect milk at the doorsteps of donors. In a study in South Korea, Jang *et al.* documented a large number of volunteers from the community [4]. However, as our HMB is in its initial stages of operation, extramural volunteers were not motivated due to logistical and ethical considerations. Furthermore, this HMB does not practice extramural distribution of PDHM. The mean age of the donors in this study was 23.53 years. In a study by Meghwal *et al*. from Rajasthan, the maximum numbers of donors were in the age group of

Table 2: Profile of HMB Donors

S. No	Parameter	Donors with Term babies (n=882) (%)	Donors with Preterm babies n=286 (%)	Total (n=1168) (%)	p value
1	Age of donor (years)				
	<20	163 (18.48	60 (20.1)	223 (19.09)	0.136
	21–30	688 (78)	220 (76.92)	908 (77.74)	
	31–40	28 (3.17)	6 (2.09)	34 (2.91)	
	>41	3 (0.3)	0	3 (0.26)	
	Mean age	23.61±3.32	23.28±3.11	23.53±3.27	
2	Average milk donated/day (years)				
	<20	79.5	76.2	77.85	0.645
	21–30	77.5	77.3	77.4	
	31–40	76.9	45	60.95	
	>41	127	0	127	
	Mean	78.01±51.22	76.41±51.43	77.62±51.26	
3	Gestational age	882 (75.51)	286 (24.49)	1168	
4	Bacteriological Profile				
	Culture negative	846 (95.91)	280 (97.9)	1126 (96.4)	0.604
	Culture positive	36 (4.08)	6 (2.1)	42 (3.6)	
	Klebsiella	23 (2.60)	5 (1.75)	28 (2.39)	
	E. coli	5 (0.57)	0	5 (0.44)	
	Enterococci	1 (0.11)	0	1 (0.08)	
	S. aureus	4 (0.45)	0	4 (0.35)	
	Pseudomonas	2 (0.23)	0	2 (0.16)	
	Acinetobacter	1 (0.11)	1 (0.35)	2 (0.16)	

HMB: Human milk bank, *E. coli: Escherichia coli, Staphylococcus aureus: S. aureus*

Table 3: Month-wise performance of HMB

Month	Number of donors	Volume of donated milk (ml)	Number of neonatal beneficiaries
January 2017	89	6850	116
February 2017	97	6790	118
March 2017	65	5460	114
April 2017	80	6535	118
May 2017	96	7425	120
January 2017	112	8620	118
July 2017	98	7350	120
August 2017	118	8860	122
September 2017	107	9050	122
October 2017	146	11490	124
November 2017	86	5840	118
December 2017	74	6390	114
Total	1168	90660	1424

HMB: Human milk bank

Table 4: Microbiological contaminations in Donor Milk [17-22]

Year	Authors	Predominant Organisms
1978	Roberts and Severen	*E. coli* and *Staphylococcus*
1987	Lin *et al.*	*Staphylococcus*
2003	Serafini *et al.*	Enterococcus - 36%
2010	Landers and Updegrove	*S. aureus* - 87%,
2013	Keim *et al.*	Gram-negative bacteria
2017	Present study	*Klebsiella*
2017	Singh *et al.*	*Staphylococcus* - 88%

E. coli: Escherichia coli, Staphylococcus aureus: S. aureus

20–25 years [16] while in a study from Korea by Jang *et al*., the maximum donors were in the age group of 30–39 years [4]. This may be due to the practice of early marriage and early pregnancy in India. The mean amount of milk donated by a donor in this study was 77.62 ml. A total of 90,660 ml of human milk were collected during the study period of 1 year. In another study, a total of 8,174.7 L of donor human milk were supplied during the 8-year period [4]. The volume of milk collected in this study was small when compared to other studies. In other studies, they have documented that they were conducting outdoor milk donation camps in the community from where large amount of milk was collected [16].

There were 1424 recipients in the study period, and about 74% were preterm babies. The main indication for PDHM in recipients was prematurity. The other reasons were sick orphan babies admitted for neonatal care, mothers not having adequate lactation, and for sick mothers unable to breastfeed. Since this was a retrospective study, the impact of PDHM on the morbidity and mortality of the recipients could not be analyzed. In another study, there were older recipients also, and indications such as milk allergy, adoption, and maternal chemotherapy were also documented [4].

There were 42 (3.6%) culture positive milk samples which were discarded in this study, *Klebsiella* species being the most common bacterial growth seen. It was followed *by E. coli*, *Enterococcus*, *Staphylococcus*, *Pseudomonas,* and *Acinetobacter* species. The studies by various other authors varied widely as shown in Table 4.

Post-pasteurization contamination rates in various other studies have been reported as high as 75% to as low as 2.5% [22]. The higher rates of contamination in other studies were seen in unsupervised home-collected milk [22]. In our study, the contamination rate was 3.6%. The predominant *Klebsiella* contamination may be due to the fact that the entire study sample was from the hospital and there were no extramural donors. The presence of *Klebsiella* contamination in human milk was reported as early as 1981 [23]. Rigorous cleaning of breast pumps, its tubing and milk storage containers will reduce the colonization of *Klebsiella* in them [23].

The need for PDHM in India can be understood given the size of infant milk substitutes market in India. Hence, establishing more number of HMBs will improve the neonatal survival and reduce the morbidity. To improve the milk collection, outreach camps and collection centers can be started. However, the current study has some limitations. Being a retrospective study, the complete profile of donors and recipients could not be collected. Due to logistical and economic constraints, pre-pasteurization bacterial culture, coliform counts, and isolation of yeast and molds were not done.

CONCLUSION

HMB serves as a vital lifeline for preterm and sick neonates who do not have access to mother's milk. The use of PDHM and its beneficial effects have been established beyond doubt. For a large number of preterm babies and the neonates without breast milk in India, PDHM will be the best source of nutrition. As every drop of PDHM is precious, contamination should be avoided by rigorous screening and aseptic precautions. Finally, HMBs should become an integral part of every NICU.

REFERENCES

1. Ballard O, Morrow AL. Human milk composition: Nutrients and bioactive factors. Pediatr Clin North Am 2013;60:49-74.
2. Deodhar L, Joshi S. Microbiological study of breast milk with special reference to its storage in milk bank. J Postgrad Med 1991;37:14-6.
3. Bertino E, Giuliani F, Occhi L, Coscia A, Tonetto P, Marchino F, *et al.* Benefits of donor human milk for preterm infants: Current evidence. Early Hum Dev 2009;85:S9-S10.
4. Jang HL, Cho JY, Kim MJ, Kim EJ, Park EY, Park SA, *et al.* The experience of human milk banking for 8 years: Korean perspective. J Korean Med Sci 2016;31:1775-83.
5. Kumaravel KS, Ganesh J, Balaji J, Pugalendhiraja KV, Babu BR. A study on impact of NRHM on neonatal care and clinical profile of neonates admitted in a SNCU of a rural medical college. J Evol Med Dent Sci 2015;4:14335-47.
6. Infant and Young Child Feeding Chapter, Indian Academy of Pediatric, Bharadva K, Tiwari S, Mishra S, Mukhopadhyay K, Yadav B, *et al.* Human milk banking guidelines. Indian Pediatr 2014;51:469-74.
7. Arslanoglu S, Moro GE, Bellù R, Turoli D, De Nisi G, Tonetto P, *et al.* Presence of human milk bank is associated with elevated rate of exclusive breastfeeding in VLBW infants. J Perinat Med 2013;41:129-31.
8. Brownell EA, Lussier MM, Herson VC, Hagadorn JI, Marinelli KA. Donor human milk bank data collection in North America: An assessment of current status and future needs. J Hum Lact 2014;30:47-53.
9. Ikonen RS, Miettinen A, Grönroos P. Bacteriological quality control in a human milk bank. Klin Padiatr 1982;194:295-7.
10. Simmer K, Hartmann B. The knowns and unknowns of human milk banking. Early Hum Dev 2009;85:701-4.
11. Kim JH, Unger S. Human milk banking. Pediatr Child Health 2010;15:595-8.
12. Boyd CA, Quigley MA, Brocklehurst P. Donor breast milk versus infant formula for preterm infants: Systematic review and meta-analysis. Arch Dis Child Fetal Neonatal Ed 2007;92:F169-75.
13. Quigley MA, Henderson G, Anthony MY, McGuire W. Formula milk versus donor breast milk for feeding preterm or low birth weight infants. Cochrane Database Syst Rev 2007;4:CD002971.
14. Corpeleijn WE, Vermeulen MJ, van Vliet I, Kruger C, van Goudoever JB. Human milk banking-facts and issues to resolve. Nutrients 2010;2:762-9.
15. Hylander MA, Strobino DM, Dhanireddy R. Human milk feedings and infection among very low birth weight infants. Pediatrics 1998;102:E38.
16. Meghwal B, Balai M, Jain B. Experience of human milk banking from tertiary care centre of South Rajasthan. Int J Biomed Res 2018;9:32-5.
17. Singh PH, Surana AU, Chaudhari V. Bacteriological analysis of donor human milk in milk bank in an Indian setting. Indian J Child Health 2017;4:7-9.
18. Lin FJ, Harold M, Barnhart, Bailey JS, Cox NA, Eitenmiller RR. Bacteriological profiles of human milk from individual donors and pooled samples from a commercial milk bank. J Food Prot 1988;51:467-70.
19. Roberts SA, Severen M. Bacterial growth in raw and pasteurized human milk. BMJ 1978;2:1196.
20. Serafini AB, André MC, Rodrigues MA, Kipnis A, Carvalho CO, Campos MR, *et al.* Microbiological quality of human milk from a Brazilian milk bank. Rev Saude Publica 2003;37:775-9.
21. Landers S, Updegrove K. Bacteriological screening of donor human milk before and after holder pasteurization. Breastfeed Med 2010;5:117-21.
22. Keim SA, Hogan JS, McNamara KA, Gudimetla V, Dillon CE, Kwiek JJ, *et al.* Microbial contamination of human milk purchased via the internet. Pediatrics 2013;132:e1227-35.
23. Donowitz LG, Marsik FJ, Fisher KA, Wenzel RP. Contaminated breast milk: A source of *Klebsiella bacteremia* in a newborn intensive care unit. Rev Infect Dis 1981;3:716-20.

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