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PROFILE OF DONORS TO THE HUMAN MILK BANK AT TERTIARY CARE CENTER OVER 1 YEAR

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Abstract

Background: Breastfeeding is crucial for child survival and thriving, but some infants lack access to their mothers' milk due to factors such as maternal illness or death. Donor human milk is essential for these infants as it reduces the risk of infectious diseases. This retrospective observational study explored the dynamics of milk donation at a private tertiary care centre's human milk bank over a year, focusing on the demographic, regional, and neonatal factors influencing donation patterns. **Methods:** This retrospective observational study analysed donor profiles at a private tertiary care centre's human milk bank over 12 months, from 1 January 2023 to 31 December 2023. Demographic variables, such as age, parity, mode of delivery, place of origin, birth weight, and gestational age, were recorded. **Results:** Of the 1398 deliveries, 509 donors contributed, with 39.1% of NICU admissions donating milk. Demographics revealed young donors (mean age 21.6 years) and significant proportions of primiparous mothers (33.6%) and LSCS deliveries (72.4%). South Indian mothers donated significantly more milk than North Indian mothers ($p<0.0001$), but donation rates showed no significant difference ($p=0.265$). Milk volume varied significantly according to gestational age, birth weight, and place of origin ($p <0.0001$). Linear regression analysis indicated that gestational age, birth weight, and place of origin were independent predictors of milk donation volume. **Conclusion:** This study elucidates the diverse factors affecting milk donation, emphasising regional differences and demographic nuances. Tailored strategies that consider gestational age, birth weight, and regional demographics are vital for enhancing donation rates and supporting neonatal health.

Keywords: Human Milk Bank, Milk Donation, Neonatal Care, Demographic Factors, Regional Differences, Linear Regression Analysis.

INTRODUCTION

Breastfeeding is the most natural and cost-effective method to ensure child survival and thriving. Some infants are deprived of access to their mother's own milk (MOM) due to various factors, such as maternal illness or death, abandonment, difficulty latching, or delayed milk production. In such a scenario donor human milk is the next best option when MOM is unavailable. [1-3] A child who is not breastfed faces a risk of death that is six times higher compared to a breastfed child. [4] The issue of preterm births on a worldwide scale, especially in low- and middle-income countries such as sub-Saharan Africa and Southeast Asia, poses a substantial obstacle. A vital intervention to enhance the prospects of these at-risk preterm neonates is the provision of human milk. Studies show that infants in low- and middle-income countries who are exclusively breastfed have a considerably lower risk of succumbing to infectious diseases during the first six months of life compared to those who are not breastfed at all.[5] Over the past three years, milk banking services have faced significant global challenges owing to the impact of the COVID-19 pandemic. [6,7] Milk

banking continues to confront significant challenges, particularly the absence of a comprehensive and equitable system for providing donor human milk (DHM) in many countries. This gap leaves nearly a million low-birthweight infants without access to DHM, especially in situations where there is insufficient maternal milk available, both in high- and low-resource settings. [8] Additionally, the rising demand for human milk has fuelled a commercial market. This trend, observed in both affluent and resource-limited nations, risks weakening the relationship between DHM provision and lactation support. [9] The situation is further complicated by the lack of regulations, which increases the potential for exploitation of milk providers, recipients, and healthcare services. [10, 11]

A recent study by Nangia et al. reported that most of the younger age groups are prone to deliver premature or low birth weight babies who require NICU admission or postnatal care.[5] Another study conducted among the Indian population reported that a significant number of neonates without breast milk were prone to malnutrition. However, the study reported that providing human milk will be an adequate source of nutrition which will also reduce morbidity among neonates.[12] Multiple studies have demonstrated that the use of donor milk is associated with a decreased incidence of Necrotizing Enterocolitis (NEC), a serious complication that predominantly affects preterm neonates. This highlights the importance of access to donor milk in NICUs to improve the health outcomes of preterm infants, particularly in regions where access to maternal milk is limited.[13] Human milk banks play a crucial role in providing donor human milk (DHM) to neonates who cannot receive mother's milk (MOM). This is particularly important for preterm infants in resource-limited settings. While the benefits of DHM are well established, data on the profiles of donors in specific settings, such as tertiary care centres in low-income countries, remain limited. This study aims to address this gap by analysing the profiles of donors to a Human Milk Bank (HMB), along with analysing the association between milk donation and consumption of human milk and increasing birth weight at a tertiary care centre over one year. This study also assessed the impact of a Human Milk Bank (HMB) on neonatal mortality, incidence of necrotising enterocolitis (NEC), and rate of exclusive breastfeeding.

MATERIALS AND METHODS

This retrospective observational study analysed donor profiles at a private tertiary care centre's human milk bank over 12 months, from 1 January 2023 to 31 December 2023. The centre was established in 2020 with a focus on improving newborn care and primarily serving intramural newborns in a 20-bed NICU. Approval was obtained from the institutional ethics committee, and informed consent was obtained from all donors. Demographic, social, and maternal characteristics were also recorded.

Inclusion criteria:

This study included intramural, extramural, and community donors.

Exclusion criteria:

Mother on chemotherapy agents, or radioactive agents

Mother having untreated open tuberculosis

Mother with HIV

Mothers on antipsychotic meications

Primary Objective:

Donors were classified based on demographic variables: age, parity, mode of delivery, place of origin, birth weight, and gestational age at delivery of their neonates.

Secondary Objectives:

Comparison of milk donation volume between North Indian and South Indian mothers.

The proportion of milk donated by various donor subgroups, mean milk volume per subgroup, and comparison of mean milk volumes among different donor categories.

Data collection:

This study compared milk donations between South Indian and North Indian mothers. For this classification, 'South Indian' states included Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Puducherry Union territory, Lakshadweep, Andaman and Nicobar Islands. All other Indian states were considered North Indian. Maternal addresses were recorded based on the Aadhar card information upon admission. Mothers with addresses in the aforementioned 'South Indian' states were classified as North Indian. South and North Indian donors were also classified based on their Aadhar addresses for community donors. The study noted the volume of milk donated by these two categories of mothers as well as the number of donors in each category.

Statistical Analysis:

Data analysis was conducted using the SPSS software version 21.0. Frequencies and percentages of donor subgroups were calculated, and Student's t-test was used to compare means, with a p-value of <0.05 considered statistically significant.

RESULTS

During the one-year study period, there were 1398 deliveries, with 545 (39.1%) admissions to the NICUs. Among these deliveries, 509 donors contributed to the Human Milk Bank. Approximately 39.1% of mothers with NICU admissions donated milk at least once. The average age of the donors was 21.6 ± 2.7 years, with nearly 37.8% falling below 25 years of age. The demographic profile of donors in the study revealed that the majority of donors were in the age range of 25-30 years (40.1%), followed by those aged < 25 years (37.8%), with smaller proportions falling into–30-35 years (17.3%) and over 35 years (4.7%). The gestational age at delivery of mothers showed that a significant portion was delivered after 37 weeks (70.1%), while smaller percentages were seen in the 29-31 weeks (16%) and 32-36 weeks (12.4%) categories, and a very small number delivered before 28 weeks (1.5%). Regarding the birth weight of neonates from donor mothers, the majority had a birth weight above 2.5 kg (87.4%), with smaller proportions falling into the 1.5-2.5 kg (16%) and below 1 kg (1.1%) categories, while a negligible number fell between 1-1.5 kg (1.9%).

Regarding the number of prior births, a notable proportion of donors were primiparous (33.7%), whereas the majority were non-primiparous (66.3%). Regarding the mode of delivery, a significant majority underwent lower-segment caesarean section (LSCS) (72.4%), while a smaller proportion had vaginal deliveries (26%) or assisted vaginal deliveries (1.6%). Regarding the place of origin of donors, a notable proportion originated from the postnatal ward (59.8%), with a slightly smaller percentage originating from neonatal ward admissions (54.5%) [Table 1].

Table 1: Demographic of enrolled patients

Demographic variable		Number of Patients	Percentage
Age (years)	< 25	529	37.8%
	25-30	561	40.1%
	30-35	242	17.3%
	> 35	66	4.7%
Gestational age at delivery of mothers (weeks)	<28	21	1.5%
	29-31	223	16%
	32-36	174	12.4%
	>37	980	70.1%
Birth weight of neonates of donor mothers	< 1 kg	16	1.1%
	1-1.5 kg	26	1.9%
	1.5-2.5 kg	224	16%
	>2.5 kg	1222	87.4%
Number of prior births	Primiparous	471	33.7%
	Non-primiparous	927	66.3%
Mode of delivery	Vaginal	364	26%
	LSCS	1012	72.4%
	Assisted vaginal	22	1.6%
Place of origin of donors	Postnatal ward	836	59.8%
	N/w admission	762	54.5%

Among the North Indian mothers (n=106), 44 donated milk, whereas among the South Indian mothers (n=1292), 465 donated milk. There was no significant difference in donation rates between North Indian and South Indian mothers (p = 0.265) [Table 2].

Table 2: Categorisation of Indian Mothers

Donor	Total mothers	Donated mothers	P value
North Indian mothers	106	44	0.265
South Indian mothers	1292	465	
Total	1398	509	

Among North Indian mothers, the mean volume donated was 13,780 mL with a standard deviation (SD) of 2067 mL, whereas among South Indian mothers, the mean volume donated was 145,260 mL with an SD of 21,789 mL. The statistical analysis showed a significant difference between the two groups with a p-value of less than 0.0001, indicating that South Indian mothers donated a significantly higher volume of milk compared to North Indian mothers [Table 3]

Table 3: Comparison of north and south Indian mothers for milk donation

Donor	Milk donated in mL		P value
	Mean	SD	
North Indian mothers	13780	2067	<0.0001
South Indian mothers	145260	21789	
Total	159040	23856	

In terms of gestational age, donations were relatively evenly distributed, with 3.70% coming from mothers whose babies were born before 28 weeks, 11.90% from those born between 29 and 31 weeks, 48.50% from the 32 to 36 weeks group, and 35.90% from babies born after 37 weeks. Regarding birth weight, 3.90% of the milk came from babies weighing less than 1 kg, 14.50% from those weighing between 1 kg and 1.5 kg, 46.70% from the 1.5 to 2.5 kg range, and the majority (47.90%) from babies weighing over 2.5 kg. When considering the place of origin of the donor mothers, the majority of milk donations (60.70%) were contributed by mothers from the postnatal

ward, whereas 39.30% were from those admitted through newborn admission [Table 4].

Table 4: Characteristics of neonates

Demographic variable		% of the total volume of donated milk
Gestational age (weeks)	<28	3.70%
	29-31	11.90%
	32-36	48.50%
	>37	35.90%
Birth weight (gm)	< 1 kg	3.90%
	1-1.5 kg	14.50%
	1.5-2.5 kg	46.70%
	>2.5 kg	47.90%
Place of origin of the donor	Postnatal ward	60.70%
	N/w admission	39.30%

The total volume of donated milk varied significantly across the different demographic variables in this study. For gestational age, the mean volume of milk ± standard deviation (SD) in millilitres (mL) was 282 ± 0.0001 for infants born before 28 weeks, 897 ± 0.0001 for those born between 29 and 31 weeks, 3600 ± 0.0001 for the 32–36 weeks group, and 2697 ± 0.0001 for infants born after 37 weeks, with a p-value of less than 0.0001, indicating statistical significance. In terms of birth weight, the mean volume of milk ± SD in mL was 292 ± 0.0001 for babies weighing less than 1 kg, 109 ± 0.0001 for those weighing between 1 to 1.5 kg, 3491 ± 0.0001 for the 1.5 to 2.5 kg range, and 3584 ± 0.0001 for babies weighing over 2.5 kg, with a p-value of less than 0.0001 indicating statistical significance. Additionally, the place of origin of the donor mothers also significantly affected milk donation, with a mean volume of 4537 ± 0.0001 mL from the postnatal ward compared to 4351 ± 0.0001 mL from those admitted through newborn admission, with a p-value of less than 0.0001, indicating statistical significance [Table 5].

Table 5: Comparison of demographic variables with milk consumption in neonates

Demographic variable		Total volume of milk donated in mL	Mean volume of milk ± SD, mL	P value
Gestational age (weeks)	<28	5990	282	<0.0001
	29-31	19080	897	
	32-36	76590	3600	
	>37	57380	2697	
Birth weight (gm)	< 1 kg	6210	292	<0.0001
	1-1.5 kg	2310	109	
	1.5-2.5 kg	74271	3491	
	>2.5 kg	76250	3584	
Place of origin of the donor	Postnatal ward	96530	4537	<0.0001
	N/w admission	92570	4351	

DISCUSSION

Demographically, the majority of donors fell within the 25-30 years age group, comprising 40.1% of the total, followed closely by those below 25 years (37.8%). This distribution suggests that the donor population is predominantly young. In terms of parity, 33.7% of the donors were primiparous, while the majority (66.3%) had prior births. This parity distribution indicates a mix of first-time and experienced mothers

who contributed to milk donation. A similar finding was reported by Nangia et al. in 1553 donors of human milk from an LMIC for 21 months. The study found that two-thirds (65.5%) of donors were young mothers, similar to our study, and had given birth to preterm infants. In addition, 20% of the overall population had preterm neonates with a gestational age < 32 weeks. [5] This was also reported by Pimenteira Thomaz et al. in the Brazilian population where 50% of the donors had delivered preterm neonates.[13] In contrast to our study and a few other studies, Quitadamo et al. reported that only 5.7% of donors had delivered preterm neonates.[14] A varied incidence was also reported by Sierra-Colomina et al., where only 23% of the population reported having preterm babies.[15] On the contrary, research conducted in developed countries indicates that the average age of human milk donors ranges from 31 to 33 years old. [5-10]

The mode of delivery among donors revealed a significant prevalence of lower-segment caesarean section (LSCS), accounting for 72.4% of deliveries, with vaginal deliveries and assisted vaginal deliveries accounting for 26% and 1.6%, respectively. This high proportion of LSCS deliveries among donors is noteworthy and may reflect trends in birth practices among the study population. Nangia et al. reported LSCS delivery in 683 patients with no significant effect on milk donation.[5] In our study, analysing the birth weight of neonates from donor mothers, the majority had a birth weight above 2.5 kg (87.4%), with smaller proportions falling into the 1.5-2.5 kg (16%) and below 1 kg (1.1%) categories, while a negligible number fell between 1-1.5 kg (1.9%). This distribution highlights a predominantly healthy birth weight range among the babies of donors, with a minority born at lower birth weights. Nangia et al. reported a mean birth weight of donor neonates of 2,175 grams, with 53.3% of donors delivering prematurely. About 13% delivered before 32 weeks gestation, 50.6% delivered low birth weight neonates and 20.7% delivered extremely low birth weight infants.[5] Meneses et al. reported findings parallel to our study where the mode of delivery and parity were not associated with milk donation or donors.[16]

While the donation rate did not show a significant difference between the two groups ($p = 0.265$), South Indian mothers donated a significantly higher volume of milk on average than North Indian mothers ($p < 0.0001$). This association suggests a regional disparity in milk donation volume, which could be influenced by cultural practices, dietary habits, or other region-specific factors. Pimenteira Thomaz et al. examined motivating factors that contribute to the donation of human milk were influenced by the healthcare providers, their family, friends, and advertising/broadcasting.[13] There was a significant association between the demographic variables and milk donation volumes. For instance, gestational age at delivery was significantly associated with milk volume ($p < 0.0001$), with higher gestational age categories correlating with increased milk donations. Similarly, birth weight was significantly associated with milk volume ($p < 0.0001$), with heavier birth weight categories indicating higher milk donation volumes. The place of origin of the donor mothers also significantly impacted milk donation volume ($p < 0.0001$), with those from the postnatal ward contributing a higher volume than those admitted through newborn admission. A significant association was observed, highlighting a notable difference between donors in low- and middle-income countries (LMICs) and those in high-income nations.

In LMICs, the majority of donors are first-time donors who contribute while still at the birthing facility. By contrast, donors in high-income countries tend to be long-term contributors to the community. This underscores the importance of raising awareness

among the general public regarding the significance of human milk donations. Healthcare professionals can play a crucial role by conducting counselling sessions and leveraging various mass media and social media platforms, especially in LMICs, where the demand for donor human milk is particularly high. [5,12] Nangia et al. reported that 62.3% of the total milk donated to the human milk bank came from mothers whose neonates were admitted to NICUs, indicating their significant contribution. This underscores that mothers with NICU-admitted neonates not only fulfil the milk needs of their babies, but also contribute to the milk bank's supply. However, this study also acknowledges the vital role of mothers from postnatal wards in ensuring the self-sufficiency and adequacy of a newly established human milk bank. Although 53.3% of donors delivered premature babies, they contributed 65.5% of the total donated milk, highlighting their substantial involvement. Additionally, approximately 20.8% of the donated milk originated from mothers of extremely preterm neonates with a gestational age of less than 32 weeks, emphasising their significant role in milk donation. [5] Quitadamo et al. reported similar study findings where a higher proportion of milk was donated from mothers who had delivered at < 32 weeks of gestation out of which 15.8% of the total milk was donated by such mothers.[14]

The main strength of this study lies in it being one of the few studies from an LMIC that delves into the demographic characteristics of donors in an established human milk bank. This not only informs healthcare workers about what to expect in the early stages of establishing such a bank in an LMIC, but also lays the groundwork for enhancing aspects of milk donation in developing nations. This includes efforts to improve home-based and community-based donations and increase the number of long-term longitudinal donations.

However, a limitation of our study was its retrospective nature. Additionally, certain demographic parameters, such as maternal education and economic status of donors, were not included in the analysis. These findings underscore the multifaceted nature of milk donation influenced by a range of demographic and regional factors. Understanding these dynamics is crucial for optimising milk donation programs and ensuring adequate neonatal care support. Further research should delve into the underlying reasons behind these associations, paving the way for targeted interventions and policies to enhance milk donation practices and neonatal health outcomes.

CONCLUSION

This study delves into the intricate dynamics of milk donation at a private tertiary care centre’s human milk bank over a year, revealing significant insights into the demographic, regional, and neonatal factors influencing donation patterns. Noteworthy findings include a predominantly young donor population, with a notable proportion being primiparous mothers, and a regional disparity in donation volumes, where South Indian mothers contributed significantly more milk than did North Indian mothers. Demographic variables such as gestational age at delivery, birth weight, and place of origin also played significant roles in milk donation volumes. These findings highlight the nuanced nature of milk donation and emphasise the importance of tailored strategies to enhance donation rates across diverse regions, ultimately supporting neonatal health and wellbeing.

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