

A QUALITY IMPROVEMENT PROJECT TO IMPROVE VOLUNTARY MILK DONATION IN A HUMAN MILK BANK IN A TERTIARY CARE HOSPITAL

B.Naresh¹, Kavitha R², G Babitha Rexlin², V.Bhavani Gowri Santhiya³

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Corresponding Author:

Dr. V. Bhavani Gowri Santhiya,
Email: sandyvb21121@gmail.com

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¹Associate Professor, Department of Pediatrics, Government Tirunelveli Medical College, Tamilnadu, India

²Associate Professor, Department of Pediatrics, Government Thoothukudi Medical College, Tamilnadu, India

³Department of Pediatrics, Medical Officer, Emergency Obstetric Care Centre, Chennai, Tamilnadu, India

ABSTRACT

Background: Human milk is the preferred nutrition for infants, particularly vulnerable preterm, low-birth-weight, and critically ill neonates. Donor human milk is an important alternative when a mother's own milk is unavailable. This study aimed to improve voluntary milk donation through a quality improvement initiative. **Materials and Methods:** A quality improvement study was conducted among postnatal mothers at the Government Thoothukudi Medical College Hospital. Baseline data were collected from June 2022 to September 2022, and the interventions were implemented from October 2022 to January 2024. Eighty mothers participated in the four PDSA cycles. Baseline barriers were identified using a questionnaire and a fishbone diagram. The interventions included health education, counselling, family engagement, audiovisual aids, milk expression education, and breast pumps. Donation outcomes were monitored using run charts. **Result:** The number of mothers donating milk increased from 265 at baseline to 290 in Plan-Do-Study-Act (PDSA) Cycle 1, decreased to 281 in PDSA Cycle 2, and increased to 322 and 345 in PDSA Cycles 3 and 4, respectively. The amount donated increased from 69,675 mL at baseline to 83,865 mL, 88,515 mL, 97,450 mL, and 116,060 mL across the successive PDSA cycles. Compared with baseline, PDSA 4 showed a 30.2% increase in donor numbers and a 66.6% increase in the donated milk volume. The monthly donor numbers ranged from 55 to 90, while the monthly milk donations ranged from 16,100 to 31,700 mL. **Conclusion:** Quality improvement increased voluntary milk donation, with sustained gains in donor numbers and donated volumes across four successive PDSA cycles.

INTRODUCTION

Breastfeeding and mother's own milk are the preferred nutrition for infants because human milk provides immune protection, supports gastrointestinal development, and promotes healthy growth. Such benefits are particularly crucial for pre-term, low-birth weight and critically ill neonates who are vulnerable to nutritional and immunological problems. Preterm infants may also have difficulty breastfeeding because of immature suckling and swallowing, although they have a high need for the protective components of human milk.^[1,2] Donor human milk is a valuable substitute for vulnerable neonates when mother's own milk is not available or insufficient, and is known to play a role in preventing complications like NEC, promoting healthy gut microbiota development. When prepared and

fortified as recommended, it offers the advantages of human milk.^[1-3]

Safe donor milk depends on effective human milk banks that provide proper collection, screening, processing, storage, and distribution.^[4,5] Microbiological safety is also crucial since the collected or processed milk can be contaminated during handling and become unsuitable for use. But they are also dependent on having a good and regular milk donation source as well.^[6,7] The establishment of milk bank does not automatically imply sufficient milk supply. Donation is dependent on mother's willingness and capacity to donate and influenced by individual, family, cultural and health-system factors. Other factors affecting decisions for milk donation include awareness, family experience, perceived safety, practical issues, and professional support.^[8-11]

Participation is influenced by knowledge, family support, and culturally relevant beliefs and concerns around shared human milk. At the hospital level, the lack of counselling, poor staff involvement, inconvenient procedures and insufficient logistical support can further decrease donation. These barriers can be addressed by donor awareness, professional support and practical support; many of these can be resolved through counselling, timely information and staff involvement and improved donation processes.^[12-14] Quality improvement can then be employed to discover these barriers and to implement the necessary step-wise changes in the donation process. All donor identification, counselling, recruitment, milk expression, collection and handling are monitored and can be improved as part of donation.

In a tertiary care institute, Jain et al. reported that interventions such as counselling of healthcare workers and stakeholders, introducing standardised donation procedures, aligning equipment, and adding human resources, increased the donation of milk, and this increase was sustained.^[15] Garegrat et al. showed that the value of staff education, structured procedures, and continuous monitoring to improve the collection of donor milk is a local challenge despite national guidance and established milk banking services.^[16] Therefore, interventions targeting local barriers to donor participation, such as knowledge, engagement of staff, and procedures, using a structured quality-improvement approach, can increase donor participation and the accessibility of donor human milk for vulnerable neonates.

Aim: This study aimed to promote voluntary Milk donation among postnatal mothers in the Human Milk Bank through the Quality Improvement Initiative and to create awareness among the mothers.

MATERIALS AND METHODS

This quality improvement study was conducted in the postnatal ward of the Government Thoothukudi Medical College Hospital in postnatal mothers. Baseline data were gathered between June and September 2022, while additional data were gathered following quality improvement interventions from October 2022 to January 2024.

Inclusion and Exclusion criteria

The present study involved mothers who attended the postnatal ward of Government Thoothukudi Medical College Hospital after birth. Mothers using drugs for their condition (including ATT, ART, antipsychotics, and other medications) and mothers with infectious diseases such as HIV, Hepatitis B and Hepatitis C, and syphilis were not included in the study.

Materials: Study materials included Medela Lactina and Symphony electric milk pumps, manual milk pumps, sterile stainless-steel milk collection containers, deep freezers for storing milk, milk pasteurisation apparatus, audiovisual tools, educational pamphlets, and a QR Code with a link to

educational videos about milk expression and milk donation.

Methods: A questionnaire in both Tamil and English was used to gather baseline data from 10 mothers to determine any barriers to voluntary milk donation. A Fishbone Diagram was used to analyse the identified barriers. The total number of mothers studied was 80 in four PDSA cycles, with 20 mothers per cycle. Outcomes were reported in terms of the number of donors who donated milk and the volume of milk donated (run charts). The first PDSA cycle was for poor milk production. Health education was provided to mothers and staff about hydration, healthy diet, feeding at night, milk expression, and galactagogues. Pamphlets, AV aids, and a QR code with videos to aid milk secretion were made available. Poor awareness and limited family motivation were problems encountered in the second PDSA cycle. Individual counselling was provided to mothers on milk donation, and counselling was provided to husbands and mothers of postnatal mothers on the importance of milk donation. Posters and pamphlets were made available, and gifts were offered to mothers donating. The third PDSA cycle addressed difficulties with milk expression. Hand hygiene, comfortable positioning, breast massage, correct placement of fingers and thumbs, and repeated breast compression were taught to the mothers. They were instructed to express milk properly throughout the day. Audiovisual demonstrations were provided, other manual pumps were acquired, and mothers were trained in the use of breast pumps.

Categorical data were summarized as frequencies, while milk donation was assessed using the number of mothers donating milk and the total volume of milk donated (mL) per month and per PDSA cycle.

RESULTS

The number of mothers donating breastmilk ranged from 55-90 to, with the greatest number of mothers donating in July 2022 (86) and the least in June 2022 (55). It was 71 in October 2022, 79 in November, 65 in December and 75 in January 2023 (PDSA 1). PDSA 2 was stable, between 69-72, but lowest in March (69) and highest in May (72). The values for June to September 2023 during PDSA 3 were 82, 70, 90, and 80, respectively. PDSA 4 was slightly higher, rising from 80 to 88 in November, 89 in December and 88 in January 2024. Donations improved throughout the cycles, with the highest monthly donation value of 90 in August 2023 [Table 1 and Figure 1].

At baseline, the quantity of milk donated was 16,100 mL and 18,625 mL in July and September 2022, respectively, with June 2022 donating the least (16,100 mL) and September 2022 the most (18,625 mL). During PDSA 1, it increased from 18,625 mL in October to 19,400 mL in November, 19,840 mL in December, and 26,000 mL in January 2023. PDSA 2 recorded 21,200 mL in February, 21,475 mL in

March, 19,840 mL in April, and 26,000 mL in May, respectively. During PDSA 3, the values ranged from 23,800 mL in July to 25,100 mL in June, with 24,100 mL in August and 24,450 mL in September. PDSA 4

increased from 24,750 mL in October to 31,510 mL in November, 28,100 mL in December, and 31,700 mL in January 2024 [Table 2 and Figure 2].

Table 1: Monthly number of mothers donating milk during baseline and successive PDSA cycles

	Month	No. of Mothers Donated Milk
Baseline (June 2022-Sep 2022)	Jun	55
	Jul	86
	Aug	59
	Sep	65
PDSA 1 (Oct 2022-Jan 2023)	Oct	71
	Nov	79
	Dec	65
	Jan	75
PDSA 2 (Feb 2023-May 2023)	Feb	70
	Mar	69
	Apr	70
	May	72
PDSA 3 (Jun 2023-Sep 2023)	Jun	82
	Jul	70
	Aug	90
	Sep	80
PDSA 4 (Oct 2023-Jan 2024)	Oct	80
	Nov	88
	Dec	89
	Jan	88

Table 2: Monthly amount of milk donated during baseline and successive PDSA cycles

	Month	Amount of Milk Donated (mL)
Baseline (June 2022-Sep 2022)	Jun	16100
	Jul	18625
	Aug	16325
	Sep	18625
PDSA 1 (Oct 2022-Jan 2023)	Oct	18625
	Nov	19400
	Dec	19840
	Jan	26000
PDSA 2 (Feb 2023-May 2023)	Feb	21200
	Mar	21475
	Apr	19840
	May	26000
PDSA 3 (Jun 2023-Sep 2023)	Jun	25100
	Jul	23800
	Aug	24100
	Sep	24450
PDSA 4 (Oct 2023-Jan 2024)	Oct	24750
	Nov	31510
	Dec	28100
	Jan	31700

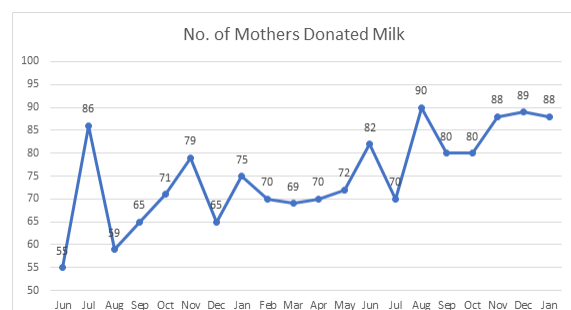


Figure 1: Monthly number of mothers donating milk during baseline and successive PDSA cycles

The number of mothers donating milk increased from 265 at baseline to 290 in PDSA 1, decreased slightly to 281 in PDSA 2, and then increased to 322 in PDSA 3 and 345 in PDSA 4. This represented a 30.2%

increase over the baseline. Milk donation also increased from 69,675 mL at baseline to 83,865 mL, 88,515 mL, 97,450 mL, and 116,060 mL across PDSA 1-4, respectively. The increase from the baseline to PDSA 4 was 46,385 mL (66.6%). The donor numbers and total milk volume were greatest at PDSA 4 [Table 3, Figure 3 and 4].

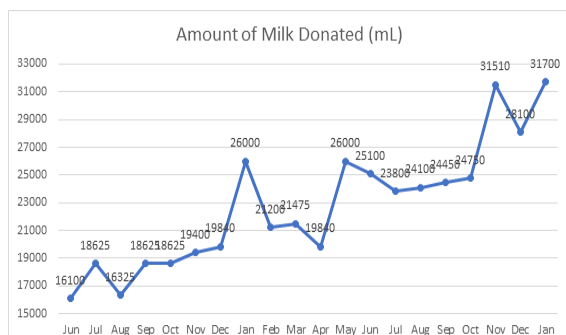


Figure 2: Monthly amount of milk donated during baseline and successive PDSA cycles

Table 3: Number of mothers donating milk and total amount of milk donated across baseline and successive PDSA cycles

		No. of Mothers Donated Milk	Amount of Milk Donated (mL)
Baseline	Jun 2022 - Sep 2022	265	69675
PDSA 1	Oct 2022 - Jan 2023	290	83865
PDSA 2	Feb 2023 - May 2023	281	88515
PDSA 3	Jun 2023 - Sep 2023	322	97450
PDSA 4	Oct 2023 - Jan 2024	345	116060

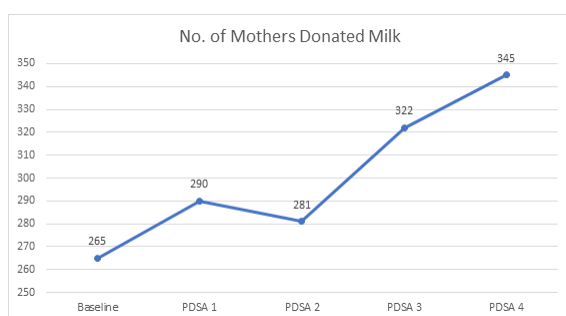


Figure 3: Number of mothers donating milk during baseline and successive PDSA cycles.

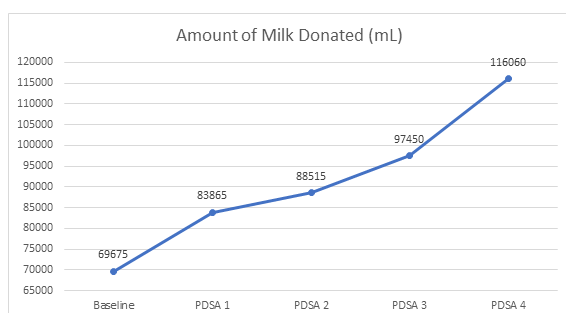


Figure 4: Amount of milk donated across the baseline and successive PDSA cycles.

DISCUSSION

This quality improvement project was evaluated using multiple PDSA cycles for voluntary human milk donation. The participation rates increased overall but slightly decreased during PDSA 2. The improvement was evident in PDSA 3 and 4. The interventions focused on mothers' milk secretion and/or consciousness of the act of milk donation, family support, and milk expression difficulty, which might have enabled the mothers to donate more. While the interventions in this study targeted donor recruitment, Sivanandan et al. showed that

interventions such as counselling, micro-teams, and areas for milk expression and correction of sterile-accessory problems resulted in an increase in mean daily donation from 0.83 L/day at baseline to 1.16 L/day during intervention, and 1.14 L/day after intervention, which did not involve any increase in the number of mothers donating¹⁷ Their findings suggest improved output from existing donors, while the interventions in this study also focused on donor recruitment.

The difference between the cycles reported by Vaddi et al. (900-1500 mL/day)¹⁸ is comparable to the variation observed in this study.^[18] Jain et al. reported a median increase in the control line of 3.41-fold from baseline to the first intervention phase (5032 mL) and then through a subsequent series of intervention and sustenance phases (6971 mL, 8122 mL, 17,181 mL).^[15] This supports repeated interventions rather than a single approach. repeated intervention as opposed to one intervention. These results are also consistent with those of Mondkar et al., who found that awareness, lack of trained personnel, inadequate milk supply for the baby, and concerns about the mother's weakness after milk expression were barriers. The importance of counselling, appropriate infrastructure, and a positive hospital environment was identified as useful areas for improvement.^[19] These findings support the use of maternal and family counselling, staff involvement, and better access to milk-expression facilities in the NICU.

In our study, the amount of milk donated also increased, with the greatest quantity during the last cycle. This matches the findings of Sivanandan et al., who noted a rise in mean monthly donation from 28.2 (SD 6.1) L to 34.1 (SD 3.7) L, with a mean difference of 5.9 L (95% CI 0.33-11.4; $p=0.03$).¹⁷ This supports the benefit of structured quality-improvement interventions for increasing collection. Jain et al. similarly reported increases from 5032 mL to 6971

mL, then 8122 mL, and finally 17,181 mL, with a 3.41-fold increase.¹⁵ Vaddi et al. reported 900, 1500, 1000, and 1100 mL/day across four PDSA cycles, showing that collection may fluctuate during implementation.^{18]} Garegrat et al. reported collection above the target of 500 mL/week after introducing counselling, videos, leaflets, and an organised collection, storage, and transport system.^{16]} These findings support combining education with practical and reliable milk-collection processes.

The progression of the PDSA cycles indicates that barriers can be addressed in stages. Vaddi et al. showed values of 900, 1500, 1000, and 1100 mL/day, while Jain et al. reported 5032 mL, 6971 mL, 8122 mL, and 17,181 mL, showing that improvement does not always follow a straight pattern.^[15,18] In contrast, Sivanandan et al. maintained collection at 1.14 L/day after reaching 1.16 L/day during intervention, despite no increase in donor numbers.^[17] Together, these findings show that donor numbers and milk volume should be assessed separately. Awareness also appears to be important. Jayanandan et al. reported that 74% of mothers were aware of milk-bank services and included 70 donor mothers and 70 recipient mothers.^[20] Among 420 lactating mothers, Jayakrishna et al. reported that urban mothers had higher awareness of milk-bank donation as compared to rural mothers (20.0% vs 11.4%). Willingness to donate was also related to urban residence (56.7% vs. 41.4%) and prior knowledge (56.7% vs. 41.4%) but not to higher education.^[14] These findings suggest that awareness, prior knowledge, and contextual factors such as place of residence may influence willingness to donate, supporting the role of structured education and counselling.

CONCLUSION

This quality improvement study showed that four PDSA cycles improved voluntary milk donation among postnatal mothers. The number of mothers donating milk also rose from 265 mothers at baseline to 345 mothers at PDSA 4, and the donated milk volume also increased, from 69675 mL to 116060 mL. The number of donors and milk volume increased with each cycle, with the best donor number and milk volume being observed in PDSA 4. Important barriers to breastfeeding were addressed through health education, individual and family counselling, the use of audiovisual materials, donor encouragement, milk expression education, and better access to milk expression equipment. Quality improvement was thus seen as offering a workable solution for enhancing voluntary milk donation, based on resource availability. These interventions can be implemented in everyday clinical practice and adapted to other lactation management units to enhance donor participation and increase the supply of donor milk for vulnerable neonates.

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