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Impact of Human Milk Banking on Maternal and Infant Health Outcomes

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Abstract
Human milk banks (HMBs) have become an important intervention to improve infant and maternal health outcomes, particularly for low birth weight (LBW), preterm, and medically fragile babies. Donor human milk (DHM) from donor banks has been proven to significantly reduce the incidence of life-threatening conditions such as necrotizing enterocolitis (NEC) and sepsis while promoting long-term immunological and neurodevelopmental benefits. Beyond its clinical benefits, human milk banks provide support to donors, particularly bereaved mothers, and alleviate the emotional burden on mothers unable to breastfeed. However, the scalability of HMBs, especially in low-middle-income countries, is limited by logistical, cultural, and awareness-related challenges. Addressing these barriers through community engagement, targeted education, and context-specific policies is necessary for maximizing the arguably positive impact of HMBs. This review synthesizes the role of human milk banks in reducing infant death and illness, promoting exclusive breastfeeding, and supporting maternal well-being. This paper also highlights the need for innovative strategies to overcome barriers and ensure the long-term sustainability of HMBs globally.

Keywords: Human Milk Banking, Donor Human Milk, Maternal and Neonatal Health Outcomes

Introduction

Human milk is globally recognized as the best source of nutrition for infants, providing essential nutrients, immunological protection, and bioactive components that are important for growth and development (World Health Organization [WHO], 2023). For babies born prematurely, low birth weight (LBW), or children facing medical complications, access to human milk can be lifesaving, possibly reducing the risk of severe complications such as sepsis, necrotizing enterocolitis (NEC), and long-term developmental delays (Perrella et al., 2021). Nonetheless, not all mothers are able to produce sufficient milk, perhaps due to medical, physiological, or social factors, creating a need for an alternative source - donor human milk (DHM) through human milk banks (HMBs). Donor milk from HMBs becomes vital repositories for collecting, processing, and distributing DHM to infants in need, typically in neonatal intensive care units (NICUs), where DHM is regularly used as a replacement until mothers can produce sufficient milk or as an alternative when maternal milk is unavailable (Ndezwa, 2020; Kim et al., 2010).

The establishment of HMBs has been transformative in improving infant health outcomes. Extant literature has shown that DHM reduces the incidence of NEC, a dire gastrointestinal disease that affects preterm infants (Adhisivam et al., 2019). In addition, DHM has been associated with reduced hospital stays, improved immunity, and enhanced neurodevelopmental outcomes (Torres-Muñoz et al., 2021). In low-resource settings, where neonatal death and illness rates remain high, HMBs offer an efficient, cost-effective, and sustainable intervention to improve infant survival. For instance, research in Sub-Saharan Africa and South Asia has demonstrated the potential of HMBs to reduce infant mortality by providing a safe alternative to formula feeding, which is often unaffordable or unsafe in these regions (Magowan et al., 2020; Obeng et al., 2023). Moreover, HMBs play an important role in promoting exclusive breastfeeding by offering support to mothers who face challenges in maintaining or initiating lactation, thereby reducing reliance on formula (UNICEF, 2019).

Beyond the health and nutritional benefits, HMBs have psychological and emotional impacts on donors and recipients. For mothers who lost their babies, donating their milk provides a sense of purpose and altruistic satisfaction, helping them to cope with grief and loss (Oreg, 2019). On the other hand, the availability of donor human milk can alleviate the stress and guilt experienced by mothers who are unable to breastfeed. This helps to foster a positive emotional environment for mothers and infants (Brown & Shenker, 2022).

Regardless of the growing literature supporting HMBs benefits, there are challenges in scaling up these services, especially in low- and middle-income countries (LMICs). Barriers such as religious and cultural beliefs, logistical constraints, and lack of awareness hinder the acceptance and utilization of donor human milk (Doshmangir et al., 2019). Mitigating these barriers requires targeted interventions, including stakeholder engagement, community education, and the development of context-specific policies and guidelines (Tyebally Fang et al., 2021). This review synthesizes the existing literature on the impact of HMBs on maternal and infant health outcomes, with a focus on the benefits of DHM for vulnerable infants, the psychological impacts on donors, and the role of HMBs in reducing neonatal mortality and morbidity in low-resource settings.

Methods

This review adopts a narrative synthesis approach to examine the impact of HMBs on maternal and infant health outcomes. This review focused on five key areas: (1) the benefits of donor human milk for preterm, LBW, and medically fragile infants; (2) the psychological and emotional impacts on donors, including bereaved mothers; (3) the role of HMBs in promoting breastfeeding and reducing formula use; (4) the long-term health outcomes for infants receiving donor human milk; and (5) the role of HMBs in reducing neonatal mortality and morbidity in low-resource settings.

A comprehensive literature search was conducted using electronic databases, including PubMed and Google Scholar. The search keywords included human milk banking, donor human milk, preterm infants, low birth weight infants, neonatal mortality, breastfeeding, and maternal health outcomes. The search was limited to studies published in English between 2010 and 2023 to ensure the inclusion of recent and relevant literature. Studies were included if they focused on the health outcomes of infants receiving DHM from HMBs, examined the psychological and emotional impacts of milk donation on donors, investigated the role of HMBs in promoting breastfeeding, provided data on the long-term health outcomes of infants receiving DHM, or discussed the implementation and impact of HMBs in low-resource settings. Studies that did not provide primary data or focused exclusively on animal studies or non-human milk were

excluded. The articles that meet the inclusion criteria were synthesized thematically to address the focus areas of the review.

This review is based on publicly available data and does not involve human participants, so ethical approval was not required.

Results

Benefits of DHM for Low Birth Weight, Preterm, and Medically Fragile Infants

Donor human milk (DHM) is proven to provide significant health advantages for preterm, low birth weight (LBW), and medically fragile infants. Several studies have highlighted the role of DHM in reducing gastrointestinal conditions that disproportionately affect premature babies (necrotizing enterocolitis). For instance, Adhisivam et al. (2019) found that the introduction of donor human milk in tertiary care hospitals in South India resulted in a significant reduction in necrotizing enterocolitis cases, with a corresponding reduction in neonatal death rates. Likewise, Torres-Muñoz et al. (2021) found that preterm babies receiving donor human milk in a Colombian hospital had significantly lower rates of necrotizing enterocolitis and sepsis relative to those fed with formula. These findings highlight the protective effects of human milk, which contains bioactive components such as lactoferrin, oligosaccharides, and immunoglobulins that support immune function and gut maturation. In addition to reducing necrotizing enterocolitis, human milk has been associated with improved neurodevelopmental outcomes and reduced hospitalization for preterm babies. Perrella et al. (2021) found that infants fed with donor human milk had better cognitive and motor development scores at 18 months compared to formula-fed infants. Moreover, donor human milk has been shown to reduce the need for invasive interventions, such as mechanical ventilation and parenteral nutrition, thereby lowering healthcare costs and improving overall infant well-being (Kim et al., 2010). These benefits are particularly needed in low-resource settings, where access to advanced neonatal care is limited. Donor milk significantly serves as a cost-effective intervention to improve survival and developmental outcomes.

Emotional and Psychological Impacts on Donors

Pidaparti et al. (2024) maintain that donating human milk has emotional and psychological implications for donors, especially mothers who lost their babies during or after delivery. For many donors, it provides a sense of purpose and a way to channel their grief into a meaningful act of altruism. Oreg (2019) also found that bereaved mothers who donated milk reported feelings of healing and empowerment, as the act of donation allowed them to maintain a connection to their lost child while helping other vulnerable infants. This therapeutic effect depicts the importance of HMBs in offering emotional support to grieving mothers, who often face stigma and isolation in their environments (Mathias et al., 2023). Beyond this, other donors also experience psychological benefits, including a sense of fulfilment and community contribution (Wagg et al., 2022). Wambach et al. (2019) conducted a descriptive study of human milk donors in the United States and found that many donors were motivated by a strong belief in the value of human milk and a desire to help others. The study further found that donors appreciated the support and recognition they received from HMBs, reinforcing their commitment to milk donation. These findings suggest that human milk banks do not only provide an important resource for infants but also a platform for fostering empathy, altruism, and community engagement among donors.

Impact on Breastfeeding Rates and Reduction in Formula Use

HMBs also play a vital role in reducing reliance on formulas while promoting exclusive breastfeeding, particularly in NICUs. By providing donor human milk as an immediate alternative to formula, HMBs help mothers establish and maintain lactation, even where they face challenges like medical complications or delayed lactation. Mondkar et al. (2018) found that the availability of donor human milk in Indian NICUs resulted in high rates of exclusive breastfeeding among mothers of preterm babies, as it reduced the pressure to supplement with formula. Equally, a study by Tyebally Fang et al. (2021) purports that HMBs in low-resource settings often serve as a bridge to exclusive breastfeeding, which offers infants the benefits of human milk while their mothers work to increase their own milk supply. Similarly, HMBs also offer the opportunity to reduce formula use, which is associated with higher risks of infections and long-term health issues. In regard, a study conducted in Brazil found that the establishment of HMBs led to a significant decline in formula feeding among preterm infants, with corresponding improvement in child health outcomes (Chaves et al., 2022). These findings underscore the importance of HMBs in creating a supportive environment for breastfeeding, particularly in settings where formula feeding is prevalent due to cultural or logistical barriers.

Long-Term Health Outcomes for Infants Receiving Donor Milk

Proof of improved immunity and neurodevelopment as well as lower risk of chronic disease exceeding the neonatal period are reported among scholars as the long-term benefits of DHM. It has been identified that DHM-fed infants show lower rates of asthma, respiratory infections, and allergies relative to formula-fed infants (Perrella et al., 2021). Again, DHM has been linked to better cognitive outcomes, with existing literature positing that preterm infants fed with DHM have higher IQ scores and better academic performance in late childhood (Torres-Muñoz et al., 2021). These benefits are attributed to the rich composition of human milk, including immune-modulating factors that promote the development of a robust immune system (Torres-Muñoz et al., 2021). In terms of economic benefits, DHM-feeding contributes to an eventual reduction of healthcare costs due to minimized chronic health conditions. A cost-analysis study conducted in Italy revealed that the operational costs of human milk banks were offset by the savings achieved through reduced necrotizing enterocolitis rates and shorter hospital stays (Salvatori et al., 2022). These findings represent the potential of human milk banks to not only improve infant health but also contribute significantly to the sustainability of healthcare systems, particularly in resource-constrained settings.

Role of HMBs in Reducing Neonatal Mortality and Morbidity in Low-Resource Settings

In low-resource settings, where neonatal death rates are unprecedently high, human milk banks offer a scalable and cost-effective intervention to improve infant survival. Studies in Sub-South Asia and Saharan Africa have demonstrated the potential of human milk banks to reduce neonatal mortality by providing a safe alternative to formula feeding, which is often unaffordable or unsafe in these regions. For instance, Magowan et al. (2020) found that the introduction of DHM in eastern Uganda led to a substantial reduction in neonatal deaths, particularly among premature and low birth weight babies. Similarly, Obeng et al. (2023) found that the establishment of human milk banks in Ghana will result in improved survival rates and reduced illness among vulnerable infants.

Despite the success stories, the implementation of HMBs in low-resource settings faces significant challenges, including cultural and religious barriers, logistical constraints, and lack of awareness.

Addressing these barriers requires targeted interventions, such as stakeholder engagement and education, and the development of context-specific policies and guidelines (Doshmangir et al., 2019). By overcoming these challenges, human milk banks have the potential to transform neonatal care in low-resource settings, providing a lifeline for the most vulnerable infants and their families.

Discussion

The findings of this review reveal the importance of human milk banks (HMBs) on maternal and infant health outcomes, particularly for premature, low birth weight (LBW), and medically fragile babies. The literature consistently shows the role of donor human milk (DHM) in reducing the manifestations of sepsis, necrotizing enterocolitis (NEC), and other severe neonatal complications, which are major determinants of infant deaths and illness (Adhisivam et al., 2019; Torres-Muñoz et al., 2021). These benefits are largely attributed to the composition of human milk, which includes lactoferrin, immunoglobulins, and oligosaccharides that support immune function and gut maturation (Perrella et al., 2021). Notwithstanding, while the clinical benefits of donor human milk are well established, their scalability and sustainability, especially in low- and middle-income countries (LMICs), remain a challenge. Logistical constraints, religious and cultural barriers, and limited awareness hinder the widespread acceptance and utilization of donor milk (Doshmangir et al., 2019). This necessitates the need for targeted interventions such as stakeholder engagement and community education to overcome such barriers (Tyebally Fang et al., 2021). Beyond the clinical advantages, human milk banks also play a crucial role in addressing the emotional and psychological needs of both donors and recipients. For bereaved mothers, donating milk offers a therapeutic outlet and a sense of purpose and connection to their lost child (Oreg, 2019; Pidaparti et al., 2024). Furthermore, the availability of donor human milk lessens the guilt and stress experienced by mothers unable to breastfeed, thereby providing a positive emotional environment for neonatal care (Brown & Shenker, 2022). The psychological benefits underscore the dual role of human milk banks as both an emotional and medical support system. Nonetheless, the emotional labour associated with milk donation, particularly for bereaved mothers, warrants further exploration to ensure that human milk banks provide adequate psychological support and counselling services (Mathias et al., 2023). In addition, the experiences and motivations of non-bereaved donors, who cite community contribution and altruism as key drivers, suggest that human milk banks can serve as platforms for fostering social cohesion and empathy (Wagg et al., 2022; Wambach et al., 2019).

Finally, the role of human milk banks in promoting exclusive breastfeeding and reducing formula use cannot be overstated. By providing donor human milk as a bridge to maternal lactation, human milk banks enable mothers to establish and maintain breastfeeding, even during challenging times such as delayed lactation or medical complications (Mondkar et al., 2018; Tyebally Fang et al., 2021). This is typically crucial in low-resource settings, where formula feeding is often considered unsafe or unaffordable (Magowan et al., 2020; Obeng et al., 2023). However, the long-term sustainability of HMBs in LMICs depends on the development of infrastructure, context-specific policies, and funding mechanisms (Doshmangir et al., 2019). While the existing literature supports the cost-effectiveness of HMBs in reducing healthcare costs associated with neonatal complications (Salvatori et al., 2022), further research is needed to explore innovative financing models and partnerships to ensure the scalability of HMBs globally. By and large, HMBs represent a vital intervention for improving maternal and infant health outcomes, but their full potential can only be realized through addressing existing barriers and fostering a supportive ecosystem for their implementation.

Conclusion

In summary, human milk banks play a crucial role in improving maternal and infant health outcomes, particularly for vulnerable populations such as preterm, low birth weight, and medically fragile infants. This review revealed that donor human milk significantly reduces the incidence of life-threatening conditions like necrotizing enterocolitis and sepsis while promoting long-term neurodevelopmental and immunological benefits. Moreover, human milk banks provide psychological support to donors, particularly bereaved mothers, and as well reduce the emotional burden on mothers unable to breastfeed. Regardless, challenges such as logistical constraints, cultural barriers, and limited awareness hinder the scalability of HMBs, especially in low-resource settings. Addressing these barriers through targeted interventions, community engagement, and context-specific policies is necessary to fully harness the potential benefits of human milk banks. By doing so, human milk banks can serve as a sustainable and cost-effective intervention to reduce infant mortality and morbidity, promote exclusive breastfeeding, and support maternal well-being.

References

1. Adhisivam, B., Vishnu Bhat, B., Banupriya, N., Poorna, R., Plakkal, N., & Palanivel, C. (2019). Impact of human milk banking on neonatal mortality, necrotizing enterocolitis, and exclusive breastfeeding. *Journal of Maternal-Fetal and Neonatal Medicine*, 32(5), 902-905. https://doi.org/10.1080/14767058.2017.1395012
2. Brown, A., & Shenker, N. (2022). Receiving screened donor human milk for their infant supports parental wellbeing: A mixed-methods study. *BMC Pregnancy and Childbirth*, 22(1), 455. https://doi.org/10.1186/s12884-022-04789-7
3. Chaves, J. O., Fernandes, A. M. F., Parreiras, P. M., Passos, M. C., da Cunha, L. R., & Menezes, C. C. (2022). Compliance in handling of donated raw breast milk to human milk banks regarding microbiological quality. Revista Brasileira de Saude Materno Infantil, 22(4), 863-870. doi:10.1590/1806-9304202200040008
4. Doshmangir, L., Naghshi, M., & Khabiri, R. (2019). Factors influencing donations to human milk bank: A systematic review of facilitators and barriers. *Breastfeeding Medicine*, 14(5), 298-306. https://doi.org/10.1089/bfm.2019.0002
5. Kim, J., & Unger, S. (2010). Human milk banking. *Paediatrics & Child Health*, 15(9), 595-598. https://doi.org/10.1093/pch/15.9.595
6. Magowan, S., Burgoine, K., Ogara, C., Ditai, J., & Gladstone, M. (2020). Exploring the barriers and facilitators to the acceptability of donor human milk in eastern Uganda – a qualitative study. *International Breastfeeding Journal*, 15(1), 28. https://doi.org/10.1186/s13006-020-00272-1
7. Mathias, E. G., Patil, D. S., Kolakemar, A., Krishnan, J. B., Renjith, V., Gudi, N., ... & Brand, A. (2023). Barriers and facilitators for the donation and acceptance of human breast milk: a scoping review. *Current nutrition reports*, *12*(4), 617-634.
8. Mondkar, J., Chugh Sachdeva, R., Shanbhag, S., Khan, A., Manuhar Sinha, M., Dasgupta, R., ... & Sabharwal, V. (2018). Understanding barriers and facilitators for human milk banking among service providers, mothers, and influencers of preterm and sick neonates admitted at two health facilities in a metropolitan city in India. *Breastfeeding Medicine*, *13*(10), 694-701.
9. Ndezwa, R. (2020). *Assessing the Need for Donated Breast Milk Use and Human Milk Banking in Kenyatta National Hospital* (Doctoral dissertation, University of Nairobi).

10. Oreg, A. (2019). Milk donation after losing one's baby: Adopting a donor identity as a means of coping with loss. *Social Science & Medicine*, 238, 112519. https://doi.org/10.1016/j.socscimed.2019.112519
11. Perrella, S., Gridneva, Z., Lai, C. T., Stinson, L., George, A., Bilston-John, S., et al. (2021). Human milk composition promotes optimal infant growth, development and health. *Seminars in Perinatology*, 45(1), 151380. https://doi.org/10.1016/j.semperi.2020.151380
12. Pidaparti, M., Knowles, G., Henner, N., Fry, J. T., Kelly, S. G., Hoggarth, J., & Robinson, D. T. (2024). Mother's Milk Donation to a Human Milk Bank During Bereavement: Circumstances Associated with Completing the Donation Process. *Breastfeeding Medicine*, *19*(9), 692-697.
13. Salvatori, G., De Rose, D. U., Clemente, M., Gentili, C., Verardi, G. P., Amadio, P., ... & Dotta, A. (2022). How much does a liter of donor human milk cost? Cost analysis of operating a human milk bank in Italy. *International Breastfeeding Journal*, *17*(1), 90.
14. Torres-Muñoz, J., Jimenez-Fernandez, C. A., Murillo-Alvarado, J., Torres-Figueroa, S., & Castro, J. P. (2021). Clinical results of the implementation of a breast milk bank in premature infants (under 37 weeks) at the Hospital Universitario del Valle 2018–2020. *Nutrients*, 13(7), 2187. https://doi.org/10.3390/nu13072187
15. Tyebally Fang, M., Chatzixiros, E., Grummer-Strawn, L., Engmann, C., Israel-Ballard, K., Mansen, K., et al. (2021). Developing global guidance on human milk banking. *Bulletin of the World Health Organization*, 99(12), 892-900. https://doi.org/10.2471/BLT.21.286943
16. UNICEF. (2019). Baby-Friendly Hospital Initiative. Retrieved from https://www.unicef.org/documents/baby-friendly-hospital-initiative
17. Wagg, A. J., Hassett, A., & Callanan, M. M. (2022). "It's more than milk, it's mental health": a case of online human milk sharing. *International Breastfeeding Journal*, *17*(1), 5.
18. World Health Organization. (2023). Breastfeeding. Retrieved from https://www.who.int/health-topics/breastfeeding