



Optimizing Human Milk Distribution: A Comprehensive Analysis of Repository Systems for Enhanced Access and Infant Well-being

Akshay Musale

Department of Computer Applications
Ajeenkya D.Y.Patil University
Pune, Maharashtra, India

Akash Bhosle

Department of Computer Applications
Ajeenkya D.Y.Patil University
Pune, Maharashtra, India

Preeti Chhabria

Department of Computer Applications
Ajeenkya D.Y.Patil University
Pune, Maharashtra, India

Rutuja Bhandarkar

Department of Computer Applications
Ajeenkya D.Y.Patil University
Pune, Maharashtra, India

Sandeep Panchal

Department of Computer Applications
Ajeenkya D.Y.Patil University
Pune, Maharashtra, India

Abstract— During the formative stages of existence, breast milk is esteemed as a paramount wellspring of essential nutrients and immunological fortification. Beyond its role in fostering optimal nourishment and bolstering the immune system, this sacred fluid facilitates in the maturation of the gastrointestinal tract and furnishes protective barriers against maladies such as respiratory infections and necrotizing enterocolitis. It is a lamentable truth that a substantial number of infant mortalities in less affluent regions can be attributed to insufficient breastfeeding practices. The “Human Milk Repository and Distributed Platform” is a platform aims to establish a sustainable system for collecting, pasteurizing, storing, and distributing human breast milk to infants in need. This is an approach to protect newborn babies from different diseases that occurs due to not receiving yellow milk by their mother. This research focuses on promoting breastfeeding and ensuring access to safe donor milk for vulnerable infants who cannot receive their mother's milk. However, indirect sharing of milk or with no real interface for such practice plus the lack of awareness on how to make a contribution might put the infants on the risks of bacteria and diseases. This assessment aims for the chassis of a web/online platform/application where receivers and donors would meet as per their wants & needs, to avail and provide the milk, with a genuine purpose to shorten the voids. The Human Milk Bank research seeks to provide a reliable and ethically sound solution to improve the health outcomes of infants worldwide.

Keywords— Human milk bank, Breast milk donation, Milk storage, Healthcare collaboration, Premature infants

I. INTRODUCTION

A “Human Milk Repository and Distribution Platform” is a service that collects donated milk from recipient mothers (nurses) who are not related to their babies. Breast milk banking offers a solution to mothers who cannot provide milk to their children due to reasons such as the risk of infection for their baby, the mother with certain diseases becoming

infected, or her child being hospitalized due to a serious illness. Birth weight is low and the mother cannot provide milk for a long time. This is because many babies (infants), especially premature babies (infants), do not get enough milk for a variety of reasons. Without a human milk bank, these babies will not be able to receive milk and will be subject to abuse [1] [2]. Premature babies (infants) receive important protection from breast milk. Unfortunately, sometimes the baby (infant) himself cannot breastfeed. Premature babies are the sixth and most important group of babies who need other women's milk due to lack or insufficient breast milk (3). Humane milk banks store, filter, pasteurize and distribute human milk to hospitals or outpatients. In general, humanitarian milk banks collect, store and process human milk according to specific instructions. The most important source of breast milk donations are breast milk banks. The suggested "Human Milk Repository and Distribution Platform" is a completely computerized system that eliminates all of the system's shortcomings while giving several amenities for the user (Administrator), such as management. Application form for milk donor details, pasteurization details, culture details, discard details, dispense details, royalty card details, store summary as well as reports, etc.

Breast milk is a special kind of bioactive material that is unlike any other milk produced by mammals. Its bioactive ingredients are critical to the development of the newborn's undeveloped immune system in addition to providing all of the nutrition required for the developing baby throughout the first six months of life. Breastfeeding has been demonstrated to be the most economical preventive measure to lower infant mortality because of these benefits. Not every newborn can nurse from delivery, even though all newborns can benefit from breast milk. These include infants that are

too sick to nurse, extremely preterm, or low birth weight. In other words, the babies who are most vulnerable to morbidity and death are also the ones who are most likely to miss out on the life-saving benefits of breast milk.

Breast milk from the newborn's own mother is the optimal choice, providing essential nutrients and immune support. However, in situations where maternal milk is unavailable or insufficient, donor human milk from reputable human milk banks serves as a vital alternative. This framework delineates fundamental requirements and quality standards applicable to all human milk banks. While recognizing the diverse resources, risks, and cultural contexts that shape human milk banking regulations, our research paper offers an evidence-based summary of essential elements and contemporary practices. Rather than prescribing specific recommendations, the framework aims to guide implementers and policymakers in developing context-specific guidelines tailored to each institution, region, or country.

The objective is not to impose uniform regulations but to provide a valuable resource for establishing connections within the global community of breastfeeding and human milk users. By equipping legislators, health departments, medical professionals, and healthcare facilities with relevant information and tools, this research aims to foster the foundation and support of locally suitable human milk banks. Ultimately, our research endeavors to ensure equitable access to human milk—whether through breastfeeding or, in emergencies, donor human milk—for every infant worldwide at risk of malnutrition.

The research was carried out to overcome the following issue:

- The CPU is the main unit that processes all calculations and commands sent to other parts of the computer and peripherals. CPU operating speed is at your disposal. These features are important and important when working with a CPU. Therefore, it is necessary to choose the right one and work accordingly. The most popular CPU manufacturers in history are Intel and AMD, and the goal of the process is to find a suitable and powerful processor.
- Manual systems require documentation in the form of numerous files and manuals. Maintaining vital information in files and manuals is both risky and time-consuming. The research, which includes a framework for gradually using Internet technologies as abilities and confidence build, shows the path from modifying materials to establishing an online environment.
- The main focus is to create a Human Milk Repository and Distribution Center to tackle infant malnutrition by providing a reliable source of safe breast milk. Designing an efficient Human Milk Bank system to provide safe donor breast milk for infants in need. Addressing challenges in collection, storage, screening, and distribution.
- In some emergency scenarios, it is very difficult to examine all of the facts, such as how much milk is available, the type of milk, whether the milk is pasteurized or not, and whether whatever milk is left is good for the newborn baby, etc. As a result, this program saves them time and allows them to

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An overview of the main subjects covered in the study is provided in this section. It gives readers a clear understanding of the paper's primary focus and highlights the significance of the distribution and repository of human milk. In this paper Section I, covers the introduction and emphasize the importance of the Human Milk Repository and Distribution Hub. The goal is to set the stage for the discussions and analysis that come next and research gaps are also mentioned. The Section II, covers a Literature review, to investigate earlier studies on mother milk banks, a comprehensive assessment of the literature is done. The goal of this review is to find any shortcomings or gaps in the body of research that already exists, giving the current study a solid foundation. Several writers offer their opinions on the topic and add their thoughts and recommendations to this area. Section III includes methodology for application that will be executed and mention in future work, along with the process flowchart that explains how the human milk distribution and repository system operates is defined. This section provides clarification on the system's implementation and functionality by outlining the procedures involved in its operation. Data has been collected in the form of questionnaire. Initially the data has been collected in small scale. This survey makes it possible to collect useful data and participant insights, which strengthens the study's empirical foundation.

II. LITERATURE REVIEW

It has been a century since Human Milk Banks began using donor human milk to save infants. In paper [4] author described that Human milk banks were developed in North America at the start of the 20th century. In the 1940s, the United Kingdom became the first country to developed a mother milk bank, and Brazil did the same in the 1950s. There are already more than 500 milk banks in operation in more than 50 nations. Brazil has had remarkable success with human milk banks its global network is the biggest in the world, consisting of 215 milk banks and 198 collecting centers [4]. The Brazilian Network of Infant Feeding Hub has successfully proven a government sponsored and integrated Human Milk Repository and Distribution Platform that encompasses lactation support, breastfeeding promotion, and donor milk provision[4].

There were also worries about the safety of Maternal Milk Repository donors as well as the challenge of ingesting the milk of another woman. The participants believed that to increase acceptability, people would need to be made aware of the benefits of mother milk and the processes execute in not only obtaining but also processing donor milk. The results of this study will be used to impact the process of donating mother bank and improve and encourage breastfeeding practices at St. Francis Hospital Nsambya. if a maternal milk repository is established. Dr. Armida Fernandez founded the first newborn feeding hub in Asia in 1990 at the Lokmanya Tilak Municipal Medical College in

Mumbai, India. There are about 60 or so milk banks in India, but they are not quite enough to fulfill enormous demand for human milk donors. As per study, India has 28 million births annually and just 60 functioning milk banks, compared to United Kingdom's 760,000 births annually as well as its 15 milk banks [5].

There exist deficiencies in the provision of capable leadership for the exchange of robust procedures and best practices. But in other areas of the nation, the shifting terrain has made it easier for human milk banks to grow by constructing websites. There is a need for a human milk repository and Distribution Platform and infants require mother milk to maintain their health. Human milk repository and Distribution Platforms are necessary, and newborns need their mothers' milk to stay healthy. According to the data mentioned above, all newborns are breastfed for the first hour of their lives. At that time, hospitals could obtain the milk they needed in an emergency by using a website [6], [7].

A "Human Milk Repository and Distribution Platform" idea raises serious concerns about malnutrition. It helps to reduce the risks of malnutrition, particularly in regions where its negative effects are more likely to occur, by giving breastfeeding to newborns in need of protection. The objective is to set uniform standards for the creation of human milk banks, as well as requirements for service and quality standards, and control criteria for the supervision of mother bank activities. Many challenges have been faced in the set up of milk banks, including poor awareness, a very low lactation counselors, and inadequate collaboration between obstetricians and pediatricians [8] [9].

The World Health Organization (WHO) advises neonates with low birthweight or premature birth to receive enteral feedings of donor mother milk. When it is not possible or is not recommended to provide mother milk, pasteurized donor human milk should be used as a substitute nutritional intervention so they can get milk from the special Human milk banks where it's treated to be safe. For the benefit of those who have been prescribed human milk by medical professionals, the human milk repository and Distribution Platform offers the service of choosing, gathering, storing, and delivering donated maternal milk. The European Milk Bank Association (EMBA) was founded in 2010 with the goals of encouraging international collaboration between human milk banks across Europe and campaigning for breastfeeding and milk banking described by the author [10][11][12].

The Human Milk Repository and Distribution Platform has successfully registered over 700 donor mothers on its platform and data related to 65000 milliliters of donated milk has been recorded on the application. Approximately 500 human milk banks are now in operation in over 37 countries globally. Human milk banks have grown, and by 2020, there will be 756 sites spread over 66 countries mentioned by the author [13].

Utilising the Early Childhood Nutrition Centre is more likely to occur if medical professionals encourage it, offer information on breast milk expression, and help with breastfeeding. Babies admitted to the neonatal intensive care service have been connected with a slow rate of Human milk centers. The rate of newborn and neonatal death has been reduced to one in ten due to the success of the Human milk repository and Distribution Platform. There are about 60 or so mother banks in India, but breast milk donation facility are not quite enough to fulfill the enormous supplying for maternal milk donors. As per the study, India has 28 million births annually and just 60 operational banks, compared to the United Kingdom's 760,000 births annually as well as its

15 milk banks. The creation of an effective, regulated national human milk repository and Distribution Platform in India has historically advanced slowly Breastfeeding from birth is crucial for an infant's overall health. since it influences the maturation and development of the immune system. Ninety-one percent of newborns in Uganda are nursed during the first hour of their lives. The World Health Organization states that newborns who are preterm or underweight at birth ought to be given their mother's milk. if this is not feasible, pasteurized breastmilk facility should be used. The "wet nursing method" was the initial approach taken to solve the lack of neonatal nutrition.. Later, pasteurised donor human milk (PDHM) became the standard when "formal mother banking" was created.

The rate of newborn and neonatal deaths has been reduced to one in ten because of all of these initiatives. Brazil's integrated human milk banking scheme is expected to save the country \$540 million annually while also improving baby health outcomes. As of 2016, there were more than 500 human milk banks, most of which were located in Europe and the United States. Australia has four, Asia has forty-four, Europe has two hundred and six, and Africa has seventy. There are fifty in South Africa, one in Nigeria as well as six in Cameroon. Since then Facilities for Lactation Support have grown, and by 2020, there will be 756 sites spread over 66 countries [14]. Human milk repository and distribution centers are more likely to happen if medical professionals encourage it, offer information on breast milk expression, and help with breastfeeding. Babies admitted to the neonatal intensive care service have been related with a slow rate of childhood nutrition. Cultural and religious taboos (14%), fear of genetic trait transfer (22%), and fear of disease transmission (28%), among others, are further barriers to the adoption of DHM [14]. The creation of effective, regulated national human milk banks in India has historically advanced slowly. The majority of Infant Nutritional Resource Centre were initially situated in the nation western belt since the first one was established here and most others were built upon it. Several challenges have been faced in the initiating of newborn feeding hub, including poor awareness, a low rate of lactation counselors, and inadequate collaboration between obstetricians and pediatricians. There exist deficiencies in the provision of capable leadership for the exchange of robust procedures and best practices. But in other areas of the nation, the shifting terrain has made it easier for human milk banks to grow by constructing websites. There is a need for human milk banks and infants require mother milk to maintain their health. As the above research shows all low birthweight babies are breastfed within the first two hours of their birth. At that time hospitals demanded milk in urgency with the help of a website that can get the milk.

III. METHODOLOGY

This research covers the Human Milk Repository and Distribution Platform, offers an online registration platform for donor mothers who kindly provide their milk. To verify that the donor mother does not have any underlying medical issues, a thorough health evaluation is carried out after registration. Adhering to stringent procedural guidelines, she expresses her milk and it is quickly frozen to stop microbiological deterioration. Donors who wish to express or handle milk must thoroughly wash their hands. Before being pasteurized, frozen raw breast milk can be kept for three to six months.

To stop bacterial growth and milk deterioration, milk must be transported at the right temperature and kept

refrigerated or frozen. It is inappropriate to donate milk that has been out at room temperature for more than six hours. In specific circumstances, medicinal tissues like blood and donated milk are transferred using volunteers. Other Human Milk Bank systems use first responders, ambulances, or postal services as their means of conveyance. Donor milk is kept cold by being kept in appropriate containers with insulation and ice packs. After being delivered to approved milk banks. As shown in Fig. 1, the milk is subsequently transported to designated milk banks, where it undergoes pasteurization to eliminate pathogenic microorganisms, thereby extending its shelf life. Precise pasteurization processes are needed to heat milk to temperatures that can kill bacteria, viruses, and other potential pathogens while reducing the impact on the milk's beneficial components, like proteins, antibodies, and vitamins. Depending on the HMB configuration, different pasteurization methods may employ both automated and less costly manual procedures.

To further enhance the immune system and general health of the baby, the milk is cultured to include advantageous probiotics. Once the milk has been carefully processed, it is given to the designated recipient, providing the best nutrients possible and promoting the health of the baby. Donor milk that has been stored is usually refrozen before being given to the baby. Carers adhere to the feeding procedures that the clinic specifies, and to avoid bacterial contamination, feeding tubes should be changed on a schedule [15]. To facilitate future tracking and tracing, HMBs and clinics that take milk from the HMB should work together to set up a documentation system for documenting how donor milk is used. To guarantee the effectiveness, safety, and purity of the supplied milk, stringent quality control protocols are also adhered to throughout the entire process. This systematic approach not only safeguards the health of vulnerable infants while also playing a role in furthering medical research and advocating for public health initiatives.

The smooth support of our kind donors is our top priority within our donor pool, which is the foundation of the Human Milk Repository and Distribution Platform, ensuring a steady and reliable supply of donated milk.

The system provides complete lactation support, high-quality expression equipment, and easily accessible pre-labeled serologic blood testing kits to any woman who feels compelled to join our cause. By making it easier for donors to do testing at their clinics, these kits speed up the screening process and reduce unnecessary stress or inconvenience. For us, it's critical to establish and maintain strong bonds with our donors. By using this system, it creates a space where donors feel appreciated and motivated to carry on with their selfless gifts by being open and honest with one another, providing constant support, and building trust. Fig.1 shows an overview of "Human Milk Repository and Distribution Platform".

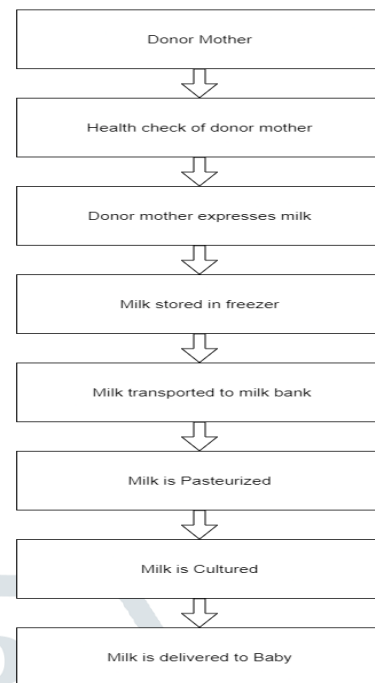


Fig. 1. An overview of "Human Milk Repository and Distribution Platform"

IV. DATA COLLECTION

Data has been collected in the form of questionnaire which includes socio-demographic details. Many ladies in the community were given access to online survey. The rate of response was satisfactory. For this investigation, the convenience sampling strategy was employed. The primary objective of this study is to assess the significance of the website known as "Human Milk Repository and Distribution Platform" and to check the people awareness related to this system and to provide a proper justification that to what extend this research is needful and helpful in real life scenarios.

The primary objective of this study is to conduct a comprehensive evaluation of the Human Milk Repository and Distribution Platform website, focusing on assessing its functionality, usability, and overall user experience. Additionally, the study aims to determine the level of awareness among the target audience regarding the existence and functionality of the system. The primary areas of human milk awareness and necessity are reflected in the research study's findings and the evaluation that was subsequently conducted on the responses. The questionnaire was completed by 986 local people, who were chosen to share their findings. The following is an analysis of the survey data.

Data collection efforts reveal widespread support for the concept of mother milk banks, with the majority of respondents recognizing the necessity of a repository and distribution center for human milk. However, awareness about existing milk bank systems remains limited, highlighting the importance of public education and outreach initiatives [16]. Fig. 2, describes how the survey express the necessity of "Human Milk Repository and Distribution Centre". Fig. 3, illustrates 83.6% of respondents lack awareness regarding the milk bank system, while only 16.4% demonstrate familiarity with the system. According to Fig. 4, 89.4% of respondents believe that an online platform is needed and in favour of "Human Milk Repository and Distribution Platform" to handle their requests and donations, while 10.6% disagree with this idea.

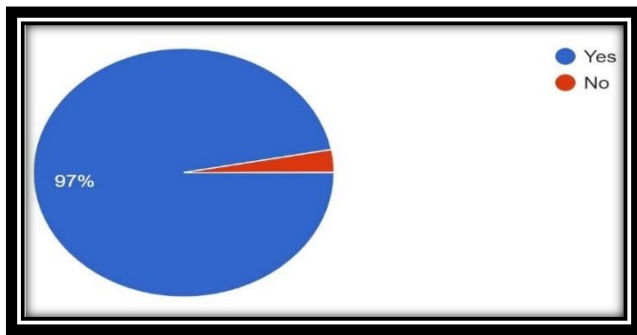


Fig. 2. The necessity of "Human Milk Repository and Distribution Centre"

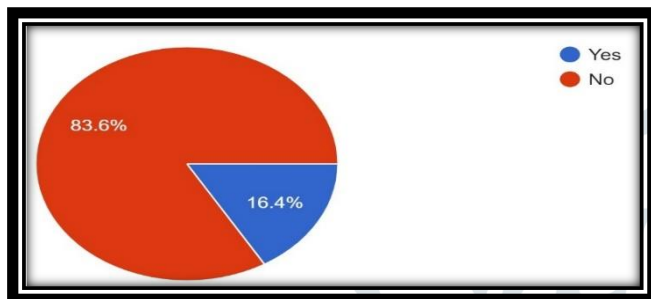


Fig. 3. People awareness regarding "Human Milk Repository and Distribution Centre"

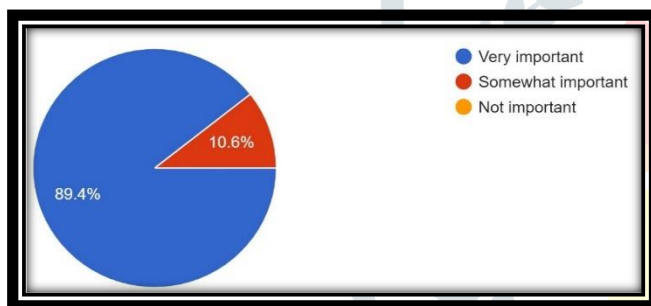


Fig. 3. People awareness regarding "Human Milk Repository and Distribution Centre"

According to survey findings, 88.1% of women express a willingness to donate breast milk to a human milk bank, while 11.9% indicate a lack of willingness to do so. Additionally, the survey reveals that locally, 98.5% of women have never donated breast milk. Furthermore, 76.1% of respondents exhibit strong support and enthusiasm for the concept of a human milk repository and distribution center, rating it favorably on a scale of 1 to 5.

V. CONCLUSION

Human milk repository and distribution platform serves an important role from collecting milk to delivering milk to newborns who do not obtain enough breast milk from their mothers. These institutions contribute to the health outcomes of vulnerable babies, particularly preterm infants, by collecting, screening, pasteurizing, and distributing donated milk. Despite its usefulness, human milk banks suffer resource restrictions, logistical obstacles, and regulatory barriers.

The establishment of a Human Milk Repository and Distribution Platform represents a significant step towards addressing infant malnutrition and promoting breastfeeding practices worldwide. By leveraging technological advancements and community engagement, this initiative strives to ensure equitable access to safe donor milk, thereby safeguarding the health and well-being of vulnerable infants. Continued collaboration between healthcare professionals,

policymakers, and the community is essential to realize the full potential of human milk banks in supporting infant health and nutrition.

With increasing technological improvements, there is potential for more automation and optimization of operations within human milk banks. The integration of innovative software systems for inventory management, donor monitoring, and milk processing might improve operations and efficiency. Further study into the advantages of human milk and its components may lead to the development of new technologies for milk preservation, storage, and fortification. This might boost the quality and nutritional content of donor milk, particularly for vulnerable groups like preterm newborns. Human milk banking services can be expanded to reach a larger population. This might include opening new milk banks in disadvantaged regions and launching outreach programs to educate healthcare practitioners and the general public about the value of donated milk.

Collaboration between human milk banks on a national and worldwide scale might improve information exchange, protocol standardization, and resource pooling. This might encourage uniformity in methods and make donor milk more accessible to infants in need throughout the world. Future initiatives may center on campaigning for legislative reforms and regulatory frameworks that enable the establishment and operation of milk banks. Clear norms and regulations might contribute to the safety, quality, and ethical acquisition of donor milk.

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