Human milk banking: a bridge between the preterm mother and infant; the experience from a greek public perinatal center

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Globally increasing scientific knowledge has acclaimed the treating of preterm infants with mother’s own raw milk as well as the practice of donor human milk feeding, combined with the early initiation of breastfeeding, as a basic nutritional policy for preterm infants in Greece. Nowadays, donor human milk banking is being promoted and underpinned as the most basic element of the Greek national breastfeeding policy for preterm infants in Neonatal Intensive Care Units (NICU). Donor Human Milk Banks, besides gathering, screening, and pasteurizing donor’s human milk consist a bridge between the preterm mother and infant, especially during the first days of lactation, that preterm mother’s milk cannot completely fulfill her infant’s needs. Human milk banking represents an advantageous tool for breastfeeding promotion. As found in recently conducted studies, preterm neonates treated only with an absolute human milk diet, including both raw maternal and donor banked milk, even from the first minutes of life, are able to initiate breastfeeding earlier compared to those infants, who are fed mainly with a preterm formula, that achieve later on time to initiate bottle-feeding. The policy of early aggressive nutrition even from the first hour of life with the minimal enteric feeding, is now practiced, by most neonatologists, in our country too, while early nutrition is also thought to be safe in terms of lifelong biological effects. For all the infants, both terms and preterms, human milk imposes a positive immune protection and enhances the emotional relationship between mother-newborn. Nonetheless, the nutritional value of preterm mother’s milk is not completely defined as various analogies of macronutrients (protein, fat and carbohydrates), as well as energy have been analyzed in several studies. Reinforced bovine human milk fortifiers supplement with extra macronutrients and energy the raw and donor banked human milk, while the practice of performing targeted fortification, results in short-term improvements at hospital discharge, in neonatal anthropometric characteristics, feeding tolerance and length of stay in NICU.

Keywords: baby friendly hospital; donor human milk bank; breastfeeding; preterm infants

Introduction

In recent years, in Greece, as in most developed countries, we have witnessed a significant increase in the survival of infants born with a low birth weight (LBW), especially those being very low birth weight (VLBW) ones. Those elevated survival rates are partly attributed to the fact that most neonatologists treat preterm infants with human milk (either raw and, or donor banked), even from the first hour of life, irrespectively of the severity of the infants’ clinical condition. The benefits of treating LBW infants with human milk compared to nutritionally supporting infants only with a preterm formula have already been studied by many investigators [1-5].

Premature infants fed with breast milk present with optimum feeding tolerance, fewer healthcare associated infections (HCAIs) and episodes of necrotizing enterocolitis (NEC) as well as lower incidence of retinopathy of prematurity (ROP), less metabolic diseases, lower incidence of blood hypertension, diabetes and obesity in childhood, fewer allergies and asthma [1-5]. All those well documented benefits are stemming from the unique properties which human milk provides, as its immunoprotective and antioxidant factors provide significant protection against the HCAIs and the oxidant trauma. Feeding with human milk also imposes a statistical significant positive effect on LBW infants’ cognitive evolution, as stated in a meta-analysis conducted by Anderson, based on twenty well established studies. The author concluded that human milk fed infants present with higher scores for cognitive function when compared to formula fed ones [6]. Finally, healthcare associated costs induced by feeding with human milk are lower compared to formula feeding, as stated in Ball’s and Smith’s studies [7-8].

However the question of the optimal nutritional requirements of LBW infants is still not completely resolved, as preterm infants are more likely to present greater growth deficits, compared to full-term ones, in the early stages of infancy. The main reason probably, is that the early parenteral and, or enteral administration of large amounts of macronutrients and energy is still considered by many neonatologists to be insecure [9-11]. As stated in a quite old study, conducted by Anderson (1984), quantitative and qualitative variances between preterm and full-term mother’s milk, produced on a daily basis, are possible to be owed to the decreased blood flow and to the deficient differentiation of the mammary gland’s epithelial cells as well as to the lack of tight junctions between epithelial cells, which characterize the preterm mammary gland [10].

The problem of the inability of a preterm mother to nurse her infant is as old as mankind. Many years ago, in most cultures and religions, it was common to use other lactating women, called wet-nurses, to support an infant in case that a mother couldn’t breastfeed her infant. Using wet nurses was very common in the upper classes, aristocracy and monarchs. Nonetheless, in the 18th century in Central Europe this practice became fashionable even in poor classes. Though, this high demand for wet-nurses was related to increased levels of neonatal morbidity and mortality. Increased rates of neonatal morbidity and mortality resulted in a huge number of articles, that were published in scientific journals and the press, concerning the safety of the human milk derived from a wet nurse, as many of these women were alcoholic and heavy smokers. On the other hand, many of those mothers were abandoning their own infants, trying to earn as much money as they could by nursing other infants. It was then the time for Donor Human Milk Banks (DHMBs) to rise. DHMBs provide in safe conditions, donor human milk, from mothers who already breastfeed their infants and donate the excess of their milk mostly for humanitarian and altruistic reasons and not to earn money. Since the 1990s, with obvious evidence of safety, on the operating directives of a DHMB (Human Milk Banking Association of North America (HMBANA) Guidelines) and a significant number of scientific research papers, published, on the clinical benefits of donor human milk, human milk banking has been expanded worldwide [12].

So, conclusively, during those first critical days of lactation, donor banked milk consists a safe choice for preterm mothers, when their own milk is partly or completely unavailable in order to fulfill their preterm infants’ nutritional needs with an absolute human milk diet [13-15].

Nonetheless, during the past years, some neonatologists expressed the speculative concern that introducing donor milk may discourage mothers’ efforts to produce their own milk. This opinion was for some, the most significant barrier against creating DHMBs. However, nowadays, recently conducted studies, demonstrate the point that the tight collaboration between Neonatal Intensive Care Units (NICUs) and DHMBs supports preterm mothers to feed their infants exclusively with human milk, during the critical first
days of lactation. Actually, the existence of a DHMB becomes a bridge between the preterm mother and infant, contributing in maintaining lactation and in elevating breastfeeding levels efficiently, as we concluded from our experience in our hospital and as also declared in a study conducted recently by Arslanoglu et al. [14]

In our hospital, the main goal is to feed LBW infants mainly with raw maternal milk, and partially with donor banked milk during the first days of life, until the transition to full lactation and breastfeeding. Our second priority consists in feeding with donor banked milk, when mother’s fresh milk is completely unavailable (mainly for medical reasons), for at least the first three weeks of life, depending on our available donor milk stocks [15].

‘Elena Venizelou’ Human Milk Bank’s Operation

One of the Pioneer DHMBs in the world is the Donor HMB of Elena Venizelou Maternity Hospital of Athens, in Greece (established in 1947). Elena Venizelou Maternity Hospital’s DHMB is one of the two DHMBs existing at the moment in Greece, more or less, considered as a National DHMB.

As it happens in every DHMB, any nominee donor is submitted to an assiduous clinical interview combined with a series of blood tests. A special donor consent form is signed for the eligibility. Afterwards, the preparation process is explained to the mother (hand- and breast-washing with soap and water) as well as the milk collection techniques. Midwifes also explain the procedure for maintaining the sterilization of jars and for keeping an unbroken cold chain, especially when the milk is transferred to our DHMB. Donor’s breast milk is preferred to be collected by trained staff with hygienic precautions, in the DHMB. Nonetheless, complete instructions for home collection are given or e-mailed to donors in a written form, especially when donors come from all over the country. The breast milk may be expressed manually (hand expression) for the first day of lactation or with electric breast pumps. According to our hospital’s policy, simultaneous milk expression by both breasts is implemented in the DHMB and is also suggested in the written instructions’ form, by our DHMB, for home collection. Breast milk is gathered in sterile containers that are marked, with the date and time of expression. The milk is transferred under frozen condition to our DHMB. Microbiological screening of donor milk is done before, and after pasteurization. Pre-pasteurization microbiology usually results in wastage of milk in about 2% of donations, in our DHMB. All batches of collected breastmilk are refrigerated immediately until the time that the serological tests come negative. Human milk that becomes culture negative is retained at -20°C. Pooling and mixing of one or two donors’ milk is performed before the pasteurization process. Pasteurization is carried out by the Holder’s method (by heat treating the milk to 62.5°C for 30 minutes). On the other hand, the raw maternal milk is kept in the refrigerator at 0°C to 4°C, after being expressed, and is fed to the infant in 24 hours, after the expression, without being frozen before but only refrigerated [14-16].

In Greece, donors are not paid or otherwise compensated for their milk donation. Only those mothers whose infants are growing appropriately, according to the children’s development standards are eligible to become donors. These are full breastfeeding mothers, who are willing to donate the excess of their breastmilk for other infants. The donors mainly include full-term mothers, who give birth to our hospital, and preterm mothers, whose infants are nursed in our NICU, or motivated mothers from all over Greece. Our main purpose is to try to reach the maximum of donor population, by spreading awareness of breastmilk donation in all over the country, using various means, including mass communication [15].

Lactating women are eligible for donors, if they are in a good general health condition, and not regularly under some specific medications’ treatment, have enough milk after feeding their baby, and are willing to be screened for infections (HIV, Hepatitis B, C, syphilis and venereal diseases). Due to the HMBANA’s suggestions on human milk banking, the Italian Association of Human Milk Banks’ guidelines as well as the latest guidelines established by Ketan et al (2014), a mother is not eligible to become a donor, when consumes illegal drugs, nicotine, tobacco or alcohol products (>2 ounces/ day) and caffeinated drinks (>3 drinks/ day). As Ketan et al, has stated, a breastfeeding mother is also not eligible for human milk donation, when has received organ or tissue transplant, and any blood or blood product transfusion during the last twelve months, is taking radioactive or is being exposed to a chemical environmental source, or finally has a mastitis or fungal infection, either suffers from an active herpes (HSV) or varicella zoster infection [15-19].

Due to our protocol, the first priority line for the donor banked milk, in our DHMB, is those infants thought as highest-risk. These are infants born at 34 weeks or earlier; those with very low birth weight (< 1500 gr); infants who have suffered a digestive tract surgery; those ones delivered with perinatal asphyxia; and those nursed in NICU for other medical reasons.

Human Milk Banking Establishment and Exclusive Breastfeeding Rates in Greece
Organizing LBW infants’ feeding policy in a BFH supported by a DHMB

1. Coping with the controversial nutritional value of the human milk

Research, has concluded that there are significant differences in the nutritional requirements of LBW infants as compared with term ones, both in the neonatal period and probably for all of infancy. On the other hand, milk changes its composition with every hour of the twenty-four hours of the day, and during every course of lactation. Foremilk is different as compared with hindmilk, and colostrum differs from transitional to mature milk. Protein is known to decline while fat and energy are estimated to rise as lactation progresses. Though, many contradictory statements are found in the literature concerning the nutritional value of the human milk and the impact of prematurity and other maternal associated factors on its macronutrients and energy levels [20-25]. However, in most studies, found in the literature, concerning the nutritional value of donor milk, it is stated that banked milk, after pasteurization process, does not contain sufficient protein, fat and energy levels to sustain adequately a LBW infant, as the pasteurization process decreases mostly fat and protein analogies [26-27].

Significant variation in human milk’s macronutrients (protein, fat, carbohydrates) and energy, either being raw or pasteurized, is a barrier that needs to be exceeded, to fulfill the preterm infants’ nutritional needs. To analyze macronutrients and energy proportions, commercial infrared human milk analyzers have been proposed as efficient and practical tools. Human milk analyzers are easy to handle and provide in a single run, using only a small amount of milk (2-5 mls), the necessary information on milk’s macronutrients and energy [27-30]. Given that kind of information, neonatologists are able to easily prescribe the quantity and quality of either the bovine or human-milk based fortifiers that are necessary for each infant’s nutritional needs. [28-31] Targeted individualized fortification presupposes the macronutrients’ and energy’s analysis of human milk, while in adjustable individualized fortification, protein intake is adjusted on infant’s blood urea nitrogen levels, as Arslanoglu stated in a study, conducted on the optimization of human milk fortification [31]. In our DHMB, we primarily analyze the milk (raw or pasteurized) with a human milk analyzer, and secondarily we fortify it in such an analogy that every infant gets the amount of protein and energy that needs, in accordance to its gestational age (GA) and body weight (BW). Raw mother’s milk macronutrients and energy are analyzed periodically (two to three times a week). For donor banked milk, macronutrients’ and energy’s analysis is conducted as soon as the milk is pasteurized [14, 16, 27].
Our experience is that this feeding and fortification policy, when infants are fed with an exclusive targeted fortified human milk diet, results in improved neonatal outcomes at hospital discharge. Indeed, those infants receive on a daily basis, the amount of protein and energy they need, properly adjusted on their specific daily nutritional needs. As a result, feeding intolerance episodes are avoided and birth weight is regained easier and earlier [16].

2. Human Milk Fortification and Early Aggressive Nutrition

In several studies, as in Sullivan’s and Hay’s ones, it is mentioned that cow milk-derived fortifiers can augment human milk’s macronutrients and energy. Nonetheless, the possibility for NEC may be increased, probably due to the possible inflammation that can be induced by the cow milk protein [26, 32]. Instead, a fortifier derived exclusively from human milk, is assumed, by some investigators, to be able to reduce the risk of NEC more effectively. Nonetheless, bovine human milk fortifiers are much cheaper compared to human-milk based ones, while some of the latest scientific papers end up that there is not so much statistical significant evidence indicating the superiority of the human-milk based fortifiers on the neonatal clinical outcomes and NEC incidence when compared with the bovine ones [28-36].

The high cost and the unknown biological product risks are mainly the reasons that human milk based fortifiers, are not used yet in Greece. In our recently conducted study (Dritsakou K., Liosis et al, 2015), we concluded that a targeted fortified diet based exclusively on human milk (raw and donor banked), using only bovine fortifiers, induced lower rates of NEC and HCAIs, compared to a diet based mainly on a preterm formula. Our main suggestion is that feeding with raw maternal milk as main, is the most effective method, to induce improved neonatal outcomes as well as lower HCAIs and NEC incidence [16]. Feeding as main with the larger, as possible, amounts of raw human milk seems to be the key solution to improve neonatal outcomes, feeding intolerance, body weight and length, head circumference, NEC, ROP and HCAIs incidence, at hospital discharge [17, 28-29]. By feeding LBW infants with mainly raw human milk combined with donor banked milk, when necessary, we achieved of providing an absolute human milk diet, with targeted fortified milk, adjusted on infants BW’s and GA’s protein and energy requirements. Using donor banked milk has become a safe choice in our NICU [16].

As stated before, we follow the individualized targeted fortification method either for raw or pasteurized milk using bovine human milk fortifiers, when feeding volumes reach 70 ml/kg per day, with scheduled protein intakes at 3.4-4.0 g/kg/d and energy intakes, 120-130 kcal/kg/d, depending on GA and BW, based mainly on ESPGHAN’s and Ziegler’s directives [28-32].

The main purpose of early feeding with the minimal enteral feeding is to incite the immature preterm gastrointestinal tract to maturate. Until maturation is achieved, the preterm gut is not able to digest and assimilate large amounts of macronutrients [28-32]. This is the nutritional gap that is replenished by the early aggressive initiation of parenteral nutrition. What is evident is that the process of maturation has to be carried out without delay, avoiding the disruption of the process. Our practice today consists in starting enteric feeding on the first hour of life in small amounts. Immediately after birth, enteric feeding is started with colostrum or donor banked milk, providing small amounts of milk at 1-2 ml/kg for the first three to four days of life, on average, especially for VLBW infants, while the quantity of the milk increases on a daily basis, ranging from 5-15 ml/kg for the first week of life, with the remaining fluid requirement covered by intravenous fluids. Finally the quantity of milk reaches the analogy of 15-25 ml/kg.

Meanwhile the parenteral nutrition is started from the first hour of life, too, according to the international standard enhanced parenteral nutrition guidelines (aggressive parenteral feeding policy). Glucose infusion is started at birth at a rate of about 4-6 mg/kg/min. Amino acids are provided in a starting dose of 3.0 g/kg/ day (no less than 2.0 g/kg/day). Meanwhile, on the following days, the dose is increased to an average of 3.5 g/kg/day. Lipid infusions are started from day 1 to day 2, on an analogy of 1.0 g/kg/day. Energy intakes are arranged to be at 120-130 kcal/kg/day several days after birth. Until that time, the maximum amount of energy without inducing hyperglycemia is provided [28, 32].

3. The transition from gavage feeding to breastfeeding

A number of methods have been tried to initiate early breastfeeding. The 'kangaroo' method with close early skin to skin contact has also aroused considerable interest. Though, to characterize a LBW infant as “ready” to breastfeed, there have to be some specific criteria accomplished such as: the coordination of sucking, breathing and swallowing and the control of cardiorespiratory function. Meanwhile, the organization of this behavior has to be expressed both in states of wakefulness and sleep [33-35]. During the first efforts of a preterm infant to breastfeed; we use the method of the non-nutritive sucking (NNS) at the empty expressed breast combined with the kangaroo care policy [36-39].

In that way the sucking reflex is accelerated whilst the milk supply is enhanced. Nyqvist demonstrated the point that
the NNS facilitates a more rapid transition to breastfeeding, decreases intestinal transit time and causes a more rapid weight gain [34]. As Jones et al, also concluded, when a preterm infant presents tolerating bolus feeds, swallowing its secretions, achieves simultaneous stable respiration and rhythmic non-nutritive sucking, it is then considered to be able of initiation of full breastfeeding [40]. Analytically, in the beginnings, the mother is asked to express the milk as totally as it is efficable from both breasts (by using an electric pump); the infant is then put to the breast under cardiorespiratory monitoring and is allowed to breastfeed. For emptying the breasts as completely as possible, electric pumps are thought as efficient as they help breastfeeding mothers express their milk easily and quickly. No major differences are noticed in the three different types of electrical breast pumps that are used in our hospital. At the same time, the expressed milk, after being fortified, is fed by intermittent bolus through a nasogastric tube. At the first efforts, sucking is permitted for only a short period of time (a few minutes), that is accelerated gradually, as days go by. Body weight is estimated daily until the infant is allowed to suck for as long as it wants with the end point being when the infant stops sucking on its own. As days go by and infants become more independent and ‘stronger’, as estimated clinically, full breastfeeding is started and this gradually replaces the combination of ‘emptied’ breast sucking and tube feeding [38-39].

According to WHO guidelines, breastfeeding LBW infants who need to be fed by a different feeding method should be fed by cup or spoon [37]. The use of a spoon or a cup is widely accepted. So, when full breastfeeding is achieved, even after hospital discharge, expressed milk is fed to infants by cup feeding, when mother’s not available to breastfeeding mothers express their milk easily and quickly. No major differences are noticed in the three different types of electrical breast pumps that are used in our hospital. At the same time, the expressed milk, after being fortified, is fed by intermittent bolus through a nasogastric tube. At the first efforts, sucking is permitted for only a short period of time (a few minutes), that is accelerated gradually, as days go by. Body weight is estimated daily until the infant is allowed to suck for as long as it wants with the end point being when the infant stops sucking on its own. As days go by and infants become more independent and ‘stronger’, as estimated clinically, full breastfeeding is started and this gradually replaces the combination of ‘emptied’ breast sucking and tube feeding [38-39].

Conclussion

Until now, the ideal nutritional method of achieving the proper postnatal growth of preterm infants has not been completely clarified. Nonetheless, what has become evident is the supreme role of early initiation of nutrition in the first hour of life, that is extremely important, not only to fulfill the instant nutritional needs that a preterm presents, but also for the biological outcomes, that will become evident later on life. The main goal is to achieve a neonatal growth rate, adequate for preterm infants combined with a normal neurological development. Raw maternal milk is considered by most neonatologists, to be the first choice for preterm infants’ feeding, while donor’s milk is the next alternative best choice. Scientific evidence exists on the protection of human milk against HCAIs, ROP, NEC, bronchopulmonary dysplasia, as well as neurological and cardiovascular complications. On the other hand, appropriately targeted fortified human milk, either being raw or donor banked, has been found to promote safely neonatal growth rates, at hospital discharge, while it also represents an instrument that promotes exclusive breastfeeding in the NICU.

References


