

## The Importance and Necessities of Human Milk Banking in Newborn Baby Feeding; A Review Article

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### Abstract

Breastfed contain many components that positively affect the infants' growth and development. There are many ways to feed babies. But, the infant's own mother's milk should always be the first option and supplies to be supportive efforts to continue lactation is very important. If the mother's milk is not available or mother cannot provide infant milk due to various reasons, donor breast milk from established breast milk bank is the preferable option. Breast milk bank can be used for reach breast milk which is gold standard, for capture to growth and development appropriate the age. Breast milk bank stands out as the first choice for newborns, but this brings with various risks. To minimize these risks, guidelines has been demonstrated that certain procedures should be followed. Although these methods affect the nutrient content of the breast milk, donated breast milk is still the best choice for baby development. More researches must be activities, should be organized to use human milk bank in worldwide.

**Keywords:** Breast Milk; Milk Banks; Newborn; Wet Nurse

### Introduction

Breastmilk are ideal and normative stand arts for infant feeding and nutrition. Proper nutrition in infancy is essential for normal growth, resistance to infections, long-term adult health, and optimal neurologic and cognitive development. Breastfeeding has short- and long-term advantages for infant neurodevelopment due to the immunological component in the structure. Also, it has short- and long-term advantages for infant digestive system therefore breast milk has the components appropriate for the enzyme structure of the newborn baby. Additionally, adequate of milk intake can be assessed by voiding and stooling patterns of the infant. A well-hydrated infants voids six to eight times a day. The mean feeding frequency during the early weeks postpartum is 8 to 12 times per day so it can meet all the needs the first 6 months for baby of mothers who do not have a health problem [1]. Breastmilk compared to other types of milk contain many components that will positively affect baby's growth and development [2,3]. Also, it reduces baby's lifetime hospital costs, incidence of necrotizing enterocolitis (NEC). And also, the studies show that breastfeeding have positive effects on feces microbiota [4-7]. Therefore, exclusive breastfeeding in the first 6 months of life, and the next 18 months to continue breastfeeding with supplementary feeding is important for the infant's physical and psychological health [2].

A mother providing milk to not own baby is based on thousands of years of history. The history of wet nurse goes back from BC 2000 the year to the 20<sup>th</sup> century. At the pictures on the tombs in Egypt have been found traces of wet nursing (<http://www.texasmilkbank.org/history-milk-banking> Date of Access: 07 June 2017). It also has given the wet nursing in terms of Hammurabi Code of the year 2250 BC [8]. Wet nursing had continued until starting with bottle feeding in the 19<sup>th</sup> century in the Middle Ages and Renaissance period [9]. When 21st Century reached, need for wet nurse decreased because of notice the possibility of disease transmission, increasing the importance of artificial nutrition products [10].

Donor breast milk firstly has emerge as a hypothesis of a doctor in 1909 “sick children will heal much faster if they are in whole or in part fed by breast milk”. When examined history, it has started to provide services first milk bank in Vienna in 1909, second in 1910 in Boston, third in 1919 in Germany. The number of milk banks in North America in 1939 reached 12 and the standards are published for these institutions has been implemented expanded in 1943 by the American Academy of Pediatrics. In 1985, the North American Breast Milk Bank Association was established [10,11]. Breastfeeding has been widely used in the 1940’s and European countries were gathered to establish a milk bank. And today 207 breast milk banks in Europe serve depends on European Mother’s Milk Bank Association [12].

In certain areas in considering the religious requirements, with the influence of cultural and religious trends, breast milk bank apply a system which includes to know each other. The recipient to the donor’s family, the system away from the pool pasteurization system [13]. For examples according to Islamic law, children fed up with the same mother’s milk become sibling [14]. Some other cultures still have several discussions about the marriage of children receiving milk of the same mother. Until the first half of the 20th century in Greek Orthodox Christians Countries it is sure that the baby milk sharing the same sex because of the children take the same mother’s milk don’t allow to marry [15]. There is a similar ban on marriage in the Slavic peoples in the Balkans, but has noted that the enforcement of the bank [16].

### The Procedures of Human Milk Banking

Technical operation in mother’s milk bank varies depending on the region where the milk bank [17]. In general, standard procedures adopted worldwide in the milk bank. The advice of Human Milk Banking of North America [11].

- The selecting of donors
- Collection of milk from the donors
- Stored in cold storage in the period up to the pasteurization of milk to be collected
- Pasteurization of milk collected
- The pasteurized milk to be stored in the freezer until the receiver baby is given
- Thawing of frozen breast milk
- The selection of the recipient baby

### The Selecting of Donors

Carefully monitored various parameters for each candidate in the election of the donors. After passing a series of blood tests it will be forwarded to a careful clinical interview. It is expected to sign a form confirming a specific donor eligibility of donors. If the donor mother has good health, she get not receive treatment on a regular drug, She has sufficient quantities of milk after breast-feeding their babies and if there is no positive for some infections (HIV, hepatitis B and C, syphilis and other infectious diseases) is considered to be appropriate. In addition, who had organs and tissue transplantation, had blood transfusions in the past 12 months, exposed to radioactivity or any environmental chemicals, has mastitis or fungal infection-related diseases, use of illegal drugs, nicotine, tobacco or alcohol consume (daily 2 or more) and consuming more than 3of caffeinated beverages per day was reported not suitable to be a donor. As well as the milk collection techniques, preparation process are explained for appropriate donors [18-20].

The procedures applied for the selection of donors varies from country to country. For example, while in some countries blood transfusion is among the criteria for exclusion, in some countries it is limited to having blood transfused within the last 4 months. Equally so, mothers are examined by serologic testing for HIV, HTLV, hepatitis B, hepatitis C. In some countries, while syphilis is taking place among these tests, in some countries isn’t [21]. The lifestyle is among the questioned at first breast milk bank in Taiwan. Tattoos, acupuncture, moxibustion, contact engage in close relationships may exceed the hepatitis barrier are among the criteria to be excluded factors [22].

### Collection of Milk from the Donors

Hand hygiene and cleaning equipment are important. Culture-based studies samples of taken from breast milk pump was determined as the total amount of bacteria that have higher  $10^3$  to  $10^7$  CFU/ml particularly *Staphylococcus*, *Streptococcus*, *Bifidobacteria* and *Lactobacilli* [10]. Donor milk is collected with the help of an electric pump or drip. Washing hands before each collection is a priority regardless of which procedure to apply. Nipple and areola should be cleaned and detergent should not be used, should be washed with only water [23]. Donors are informed about cleaning breastfeeding pump equipment. Milk bank records carefully preserves for many years. All information of the donor mother is archived with written records. All milk banks have to protect all records about recipients until their age 21 or at least 10. In addition, the name of each mother's, identification number, date of dissolution, milking method, freezing method and donor information is noted on milk containers [10].

If milking is performed in the home milk must be delivered within two or three weeks under cold chain for processing. If milking is performed in the hospital or in the milk bank it must be supported by well-trained medical staff and should be stored in cold storage within 24 hours [21].

Dropping mother's milk is obtained by collecting the dripping from the other breast while nursing their babies milk. Even though the oil composition of the milk is very low, it was observed that in those fed babies are better long-term outcomes. Ideally collection method is the electric pump providing rhythmic negative pressure [10] In several studies with the electric pump has been found to contribute to elongation to duration of lactation. In a study, regular milking process has been carried out and the production of prolactin and milk production in the group using electric pumps were found to be more depending on breast stimulation. However, it is observed no difference on the amount of milk between milking with electric pump and milking with hand in previous studies [24]. Morton and his colleagues in a study to determine which milking method is more effective for preterm infants, they have been observed that milking with electric pump and milking with hand used together are more effective than electric pump or hand milking method used alone [25]. Similarly, Jiang, *et al.* showed that duration of lactation is longer in the group fed with only breast milk than fed with only milking with electric pump feeding. And used together are more effective than electric pump or hand milking method used alone [26]. But mothers prefer the manual milking method because it is easier [24].

### Storage of the milk before pasteurization

Storage conditions influences milk nutritional, immunological the bioactive components and microbial content. Breast is ideal breast milk container. The structure of the collected container affect milk constituents [27]. Glass and semi-steel containers are formerly used, a variety of plastics are used more recently. Polyethylene, polypropylene and polycarbonate plastic containers are commonly used storage devices. Cellular content of the milk can be stick on glass containers. There is no such problem in polyethylene and polypropylene containers. The cell numbers increases after storage in 4 and 24 hours associated with the end of adhesion to the surface. Cell function shows the reduction in time. Milk proteins (lactoferrin, lysozyme, secretuar Immunoglobulin A) was observed to remain essentially unchanged, with a slight decrease. Change is not observed in the fat-soluble vitamins [25-28]. In a study half of milk were stored in heat-resistant glass bottle while the other half is stored in polyethylene containers. After 24 hours, bacterial growth was observed to be less in polyethylene containers than glass containers (respectively %11.4, %69.5). Short-term storage in the refrigerator (48 hours) the protection effect of human milk against *E. coli* bacteria polypropylene containers (made of thick plastic) found that more protection than polyethylene milk storage bags [27].

Breast milk can be stored safely in the refrigerator ( $\leq 4^{\circ}\text{C}$ ) up to 72 hours, in the freezer ( $<-17^{\circ}\text{C}$ ) up to 6 months. It is stated that extremely clean conditions in the refrigerator for no more than 5 - 8 days, in the freezer can be stored up to 12 months [29]. Researchers recommend that use of containers made of rigid plastic or glass container for long-term storage of milk. Plastic bags are made to store milk are not recommended for long term storage because of spills, leaks, soft plastic interaction of some of the ingredients of milk or decrease. These bags can be used to only short-term storage (less than 72 hours) [30].

### Pasteurization of milk

Fresh breast milk should always be the first choice for newborn babies. But the World Health Organization (WHO) and the American Academy of Pediatrics (AAP) is noteworthy that the best alternative is donated breast milk in the absence of breastfeeding [31,32]. All milk reaching the milk bank is applied pasteurization methods after several serological tests to increase the reliability of donor milk. All procedures performed reduce the amount of bacterial agent or destroy however decreases the biological and nutritional content of the milk [33]. The ideal method of pasteurization in milk bank is rapid heating and retained heat phase and rapid cooling phase. Recommendations of Italy Mother's Milk Bank Association was detected that mix of limited number of milk is preferable, maximum of 6 taken from a donor milk was put forward (D level of evidence). 62.5°C for 30 min heat treatment (holder method) is recommended method in human milk banks (A level of evidence). In the final phase of the pasteurization cycle rapid cooling process implementation has fallen below 10°C or more (C level of evidence) (4°C being preferred) [23]. Reduction of bioactive compounds and nutritional content of milk at holder method occurrence of brought to mind whether it is applicable in different methods. It was observed that thermoultrasonic heat treatment more protect the bioactive component but this method use small amount of milk. There is needed to further study the applicability to greater amounts [34]. Other alternative method of pasteurization of breast milk is high pressure applications (HPP). High pressure applications (12°C 5 min 400, 500, 600 MPa) compared with holder method. The impact they have made in the microbial profile of milk were found to be similar. But the IgE content was observed that much more protected of high-pressure treatment [35]. Also, ohmic heating of breast milk is a new method for the pasteurisation process. Ohmic process inactivates microorganisms like heat treatment. 72°C ohmic process did not affect milk proteins, 78°C has very little effect and 85°C was observed to affect too much. About of the effects of this method on the nutritional, antimicrobial and immunological components of milk is needed further work [36,37].

### The Effect of Pasteurization on Microbial Content

Donor milk may include gram negative bacteria or aerobic bacteria at more than  $10^4$  colonies per milliliter before pasteurization. And also, the amount of total aerobic bacteria, gram-negative bacteria contents, coliform bacteria and Staphylococcus species may increase during the transport, storage [38].

Applied to heat treatment of 56°C for 30 minutes to human breast milk was observed to be insufficient for microbial quality. Inactive HIV virus, reducing titers of T lymphotropic virus and other viruses destroys. However, this temperature pasteurization is not destroy CMV (Cytomegalovirus). 62.5°C for 30 min of heat treatment destroys inactivate HIV and CMV [39].

### The Effects of Pasteurization on Nutrients

Pasteurisation process leads to reduction in the amount of various immunological substance such as transferrin, lysozyme, secretory IgA, cytokines. Accordingly, the potential protective capacity of the milk is decreased [40,41]. In a study, breast milk collected in a mixed way from 20 term and preterm baby's mother and half of the milk is freezed (-80°C), the other half is pasteurized and then freezed (-80°C).  $\alpha$  and  $\beta$  casein, tenascin, lactoferrin and immunoglobulin has been observed to decrease to the only of six of twenty samples. Most of the sample was not a change occurred in protein content and has retained its biological activity [42]. Cytokines, chemokines, growth factors are compared between pasteurized breast milk with holder method with unpasteurized milk by Groer, *et al.* When the end of first week in the level of IL-4, EGF, MIP-1 $\alpha$  was observed significant difference, when reached in 6thweek MIP-1 $\alpha$  and is TNF- $\alpha$  level difference were observed. 4 cytokine (IL-1, IL-6, IL-10, TNF- $\alpha$ ) reduce from 1<sup>st</sup> week to 6<sup>th</sup> week. Donor milk has less than mother's own milk [43].

In a study, changes of donor breast milk vitamin D content with pasteurization breastmilk 25 (OH) D<sub>2</sub> and 25 (OH) D<sub>3</sub> levels were compared. After the pasteurization has been observed that a decrease of 10% -20% [44].

In another study that examined the rate of change of amino acids, fatty acids and DHA (Docosahexaenoic Acid) in pasteurized donor milk, milk samples were collected from an average age of 27 and within 3 months lactation period donors. The total average of milk protein was 0.9 g/dl. The collected milk's fatty acid levels were examined before and after pasteurization. It decreased respectively, before

and after pasteurization Linoleic acid from 125 nmol/dl to 118 nmol/dl, alpha linolenic acid from 8.38 nmol/dL to 8.3 nmol/dL, arachidonic acid from 2.8 nmol/dl to 2.7 nmol/dL. There has not been change in the DHA. As a result of the study there were no serious change in fatty acid levels after pasteurization. At the same study, valine, phenylalanine, proline, lysine, arginine, serine levels increased after pasteurization [45].

Breast milk is a unique food for both the babies to term and preterm infants. But non-enriched breast milk may not contain enough nutrients. In this situation baby's growth rate may be slower growth and development chart than normal [46]. For these reasons, various enrichment methods in milk banks are applied [47,48].

### Storage of Pasteurized Milk in the Freezer until Give Recipients

Breast milk can be stored for up to 6 months after pasteurization. During storage process is applied -18 and -20°C. This process may reduce the amount of various food components. Studies showed that freezing at -20°C cause 89% loss of cellular viability and bacteriostatic effect. Protection of Immunoproteins as IgG, IgM, IgA and also lysozyme, lactoferrin, C<sub>3</sub>, C<sub>4</sub> complement was observed. Also, it is detect that amino acids and fatty acids are protected or are affected very little [49]. Borgo., *et al.* was found that storage of collected breastmilk after the pasteurization at the -18°C up to 6 months in the bank is not effect of lipid fractions and milk fatty acid content [50]. In a similar study by Va'zquez-Roman., *et al.* examined that the effect of storage at -20°C on raw, pasteurized milk's dornic acidity. Storage time increases the acidity was also found to be increased. There is no significant difference after storage of raw milk species but it was found to be a significant difference between the end of the first week of pasteurized milk and raw milk [51]. In the past years studies highlight that mother's milk can be safely stored in the household freezer at -20°C up to 12 months or in the lab freezers at -70 degrees in undefined period of time [52].

### The Selection of Recipients Baby

Receptors of human milk bank:

- Less than 1500 grams birth weight newborns
- Maternal diseases,
- Medicines,
- Substance abuse,
- Weakness of social support
- Some allergies, food intolerance, short bowel syndrome, malabsorption and couldn't tolerate due to other gastrointestinal problems.

Baby's gestational age and birth weight is important for donor milk's distribution process. Preterm babies always have priority. Primarily preterm mother's milk is preferred for preterm infants [10,53].

### Conclusion

Although methods applied in milk banks cause a decrease in the nutritional content of the breastmilk, Compared the pasteurized breastmilk with formula, it is known that it has a more positive contribution to the growth and development of the baby. Therefore, Milk banks are important in infant feeding. Therefore, milk banks are especially important for babies who cannot take their mothers' milk. The milk bank in Turkey is on the agenda of the Ministry of Health and infrastructure studies are continuing in this regard. This study contains comprehensive information on milk banks' procedures and requirements.

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